

FLOOD INSURANCE STUDY



INDIAN RIVER COUNTY, FLORIDA AND INCORPORATED AREAS



Community Name	Community Number
FELLSMERE, CITY OF	120120
INDIAN RIVER COUNTY (UNINCORPORATED AREAS)	120119
INDIAN RIVER SHORES, TOWN OF	120121
ORCHID, TOWN OF	120122
SEBASTIAN, CITY OF	120123
VERO BEACH, CITY OF	120124

REVISED:

December 4, 2012



Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER

12061CV000A

TABLE OF CONTENTS

	<u>Page</u>
1.0 <u>INTRODUCTION</u>	1
1.1 Purpose of Study	1
1.2 Authority and Acknowledgments.....	1
1.3 Coordination.....	1
2.0 <u>AREA STUDIED</u>	2
2.1 Scope of Study	2
2.2 Community Description	5
2.3 Principal Flood Problems	6
2.4 Flood Protection Measures.....	7
3.0 <u>ENGINEERING METHODS</u>	8
3.1 Hydrologic Analyses	9
3.2 Hydraulic Analyses	29
3.3 Vertical Datum	42
4.0 <u>FLOODPLAIN MANAGEMENT APPLICATIONS</u>	43
4.1 Floodplain Boundaries	43
4.2 Floodways	44
5.0 <u>INSURANCE APPLICATIONS</u>	53
6.0 <u>FLOOD INSURANCE RATE MAP</u>	54
7.0 <u>OTHER STUDIES</u>	54
8.0 <u>LOCATION OF DATA</u>	54
9.0 <u>BIBLIOGRAPHY AND REFERENCES</u>	56

TABLE OF CONTENTS (Cont'd)

FIGURES

Figure 1: Transect Location Map..... 33
Figure 2: Transect Schematic..... 34
Figure 3: Floodway Schematic 45

TABLES

Table 1: Flooding Sources Studied by Detailed Methods..... 3
Table 2: Letters of Map Change 5
Table 3: Summary of Discharges..... 10
Table 4: Summary of Ponding Stillwater Elevations..... 17
Table 5: Parameter Values for Surge Elevations 19
Table 6: Summary of Coastal Stillwater Elevations 21
Table 7: Summary of Roughness Coefficients 29
Table 8: Transect Locations, Stillwater Starting Elevations, and Initial Wave Crest Elevations 34
Table 9: Floodway Data Table..... 46
Table 10: Community Map History 55

EXHIBITS

Exhibit 1 – Flood Profiles

Collier Creek	Panels	01P – 02P
Collier Waterway	Panels	03P – 04P
Elkcam Waterway	Panel	05P
Lateral G	Panel	06P – 06-AP
Lateral H	Panel	07P
Lateral J	Panel	08P
Localized Flooding Area 1	Panel	09P
Localized Flooding Area 2	Panel	10P
Localized Flooding Area 3	Panel	11P
Localized Flooding Area 4	Panels	12P

TABLE OF CONTENTS (Cont'd)

Exhibit 1 – Flood Profiles (continued)

Main Relief Canal	Panels	13P – 15P
North Relief Canal	Panels	16P – 17P
Schumann Waterway	Panels	18P – 19P
Sebastian Creek	Panel	20P
South Prong Creek	Panels	21P – 22-AP
South Relief Canal	Panels	23P – 24P
St. John's Marsh	Panel	25P – 26P
Vero Lakes Channel A	Panels	27P – 29P
Vero Lakes Channel B	Panel	30P
Vero Lakes Channel C	Panels	31P – 32P
Vero Lakes Channel D	Panel	33P

Exhibit 2 – Flood Insurance Rate Map Index (Published Separately)

Flood Insurance Rate Maps (Published Separately)

FLOOD INSURANCE STUDY

INDIAN RIVER COUNTY, FLORIDA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Indian River County, Florida, including the Cities of Fellsmere, Sebastian, and Vero Beach; the Towns of Indian River Shores and Orchid; and the unincorporated areas of Indian River County (referred to collectively herein as Indian River County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The new hydrologic and hydraulic analyses for this study were performed by the Watershed IV Alliance for the Federal Emergency Management Agency (FEMA), under Contract No. EMA-2002-CO-11A TO#017. This study was completed in November 2009. The history of the previous countywide studies before this current countywide study are presented below.

Indian River County and Incorporated Areas

For the original May 4, 1989, countywide FIS, the hydrologic and hydraulic analyses were performed by Gee & Jenson Engineers-Architects-Planners, Inc., for FEMA under Contract No. EMW85-C-1912. That study was completed in May 1987 (Reference 1).

1.3 Coordination

The initial Consultation Coordination Officer (CCO) meeting was held on September 25, 2007, and attended by representatives of FEMA, the Watershed IV Alliance, community

officials, St. John's River Water Management District (SJRWMD), the State of Florida, and various consulting firms.

The results of the study were reviewed at the final CCO meeting held on September 30, 2010, and attended by representatives of FEMA, the communities, and AECOM. All problems raised at that meeting have been addressed in this study.

The history of the coordination activities for the initial countywide study is presented below.

Indian River County and Incorporated Areas

For the original countywide FIS report, initial CCO meetings were held in February 1985, with representatives of FEMA, the communities, and Gee & Jenson Engineers-Architects-Planners, Inc. that produced a variety of information pertaining to floodplain regulations, corporate limits, available maps, topography, flood history, and other hydrographic data.

Agencies contacted for information for that study included the National Ocean Service, Tide and Water Levels Division and Data Control Section; the Florida Institute of Technology; the Florida Department of Natural Resources (FDNR), Division of Beaches and Shores; the Harbor Branch Foundation; the Press Journal and Today Newspapers; the Florida East Coast Railway; the U.S. Army Corps of Engineers (USACE), Jacksonville District; SJRWMD; the U.S. Natural Resources Conservation Service (formerly the Soil Conservation Service); the U.S. Geological Survey (USGS); the Florida Department of Transportation (FDOT); the Florida Department of Environmental Regulation (FDER); the Indian River Farms Water Control District; the Sebastian River Water Control District; the City of Sebastian; Indian River County; and the Vero Lakes Water Control District.

On June 13 and 14, 1988, the results of that FIS were reviewed and accepted at final coordination meetings attended by representatives of Gee & Jenson Engineers-Architects-Planners, Inc., FEMA, and the communities.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Indian River County, Florida, including the incorporated communities listed in Section 1.1.

The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction. The flooding sources studied by detailed methods are presented in Table 1, "Flooding Sources Studied by Detailed Methods."

Table 1: Flooding Sources Studied by Detailed Methods

Flooding Source	Reach Length (miles)	Study Area
Atlantic Ocean	22.3	Complete coastline of Indian River County
Blue Cypress Creek	2.5	From the confluence with Blue Cypress Lake to approximately 12,500 feet upstream of the confluence with Blue Cypress Lake
Collier Creek	1.9	From the confluence with South Prong Creek to Sebastian Boulevard
Collier Waterway	4.5	From the confluence with Elkcam Waterway to Sebastian Boulevard
Elkcam Waterway	1.5	From the confluence with South Prong Creek to the confluence of Collier Waterway
Falcon Trace	0.2*	Falcon Trace Subdivision
Indian River	21.9	From the northern county boundary to the southern county boundary
Lateral G	4.2	From the confluence with North Relief Canal to Wabasso Road
Lateral H	1.8	From the confluence with North Relief Canal to South Gifford Road
Lateral J	3.3	From the confluence with South Relief Canal to county boundary
Localized Flooding Area 1	0.4	From the confluence with Lateral J to approximately 1,900 feet upstream of the confluence with Lateral J
Localized Flooding Area 2	0.3	From 18 th Plaza Southwest to approximately 1,600 feet upstream of 18 th Plaza Southwest
Localized Flooding Area 3	1.2	From the confluence with Localized Flooding Area 1 to approximately 6,400 feet upstream of the confluence with Localized Flooding Area 1
Localized Flooding Area 4	0.6	From approximately 400 feet upstream of 18 th Plaza Southwest to approximately 2,950 feet upstream of 18 th Plaza Southwest
Main Relief Canal	6.8	From the confluence with Indian River to 12 th Street
Millstone Landing	0.5*	Millstone Landing Subdivision
North Relief Canal	5.3	From the confluence with Indian River to approximately 5,200 feet upstream of 66 th Avenue
Park Place	0.2*	Park Place Subdivision

Table 1: Flooding Sources Studied by Detailed Methods (Continued)

Flooding Source	Reach Length (miles)	Study Area
*Square miles		
Sebastian Creek	2.8	From US Highway 1 to the confluence of South Prong Creek
Schumann Waterway	1.9	From the confluence with Elkcam Waterway to approximately 5,000 feet upstream of the upstream crossing of Schumann Drive
Sebastian Highlands	0.3*	Sebastian Highlands Subdivision
Sebastian Lakes	2.1*	Sebastian Lakes Subdivision
South Prong Creek	4.1	From the confluence with Sebastian Creek to approximately 100 feet downstream of 85 th Street
South Relief Canal	5.3	From the confluence with Indian River to 58 th Avenue Southwest
St. John's Marsh	17.4	From the southern County boundary to State Road 60
Vero Lakes Channel A	4.4	From the confluence with South Prong Creek to approximately 10,500 feet upstream of 77 th Street
Vero Lakes Channel B	2.3	From the confluence with Vero Lakes Channel A to approximately 12,000 feet upstream of Vero Lakes Channel A
Vero Lakes Channel C	1.5	From the confluence with Vero Lakes Channel A to 102 nd Avenue
Vero Lakes Channel D	1.1	From the confluence with Vero Lakes Channel A to approximately 11,000 feet upstream of the confluence with Vero Lakes Channel A

* Square miles

Numerous streams were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA and the Watershed Alliance IV.

Mapping for Indian River County, Florida, and incorporated areas has been prepared using digital data. Previously published Flood Insurance Rate Map (FIRM) and Flood Boundary and Floodway Map data produced manually have been converted to vector digital data by a digitizing process.

This countywide FIS also incorporates the determination of letters issued by FEMA resulting in Letters of Map change as shown in Table 2, “Letters of Map Change.”

Table 2: Letters of Map Change

Community	Case Number	Flooding Source(s)	Effective Date	Status
Indian River County (Unincorporated)	01-04-457P	Indian River and Atlantic Ocean	01/05/2002	Incorporated
Indian River County (Unincorporated)	904113	Atlantic Ocean	04/29/91	Incorporated
Indian River County (Unincorporated)	96-04-526P	Indian River	05/13/1996	Incorporated
City of Sebastian	97-04-309P	Elkcam Waterway along Schumann Canal 98-04-061P	04/20/1998	Incorporated

2.2 Community Description

Indian River County is located near the middle of the east coast of Florida along the Atlantic Ocean. The county is bordered on the north by Brevard County; on the east by the Atlantic Ocean; on the south by St. Lucie County; on the southwest by Okeechobee County; on the west by Osceola County. The county encompasses an area of 617 square miles which includes 114 square miles of water.

Indian River County has a mild, subtropical climate, with average temperatures in the City of Vero Beach ranging from 61.7 degrees Fahrenheit (°F) in January to 81.2 °F in August (Reference 2). The wet season extends from May through October with September as the wettest month, averaging 7.61 inches of rainfall. Average annual rainfall is 55.31 inches. Prevailing winds are from the southeast and east in the spring and summer and from the northeast in the fall (Reference 3). Indian River County is less frequently impacted by direct hurricane landfalls than portions of the Panhandle or South Florida because the hurricanes are often steered northwest and offshore or they weaken to a tropical storm.

The topography of Indian River County is divided into three major areas: the St. John's River Valley; the mainland basins and coastal ridges; and the barrier islands. The mainland topography of Indian River County is generally low in elevation, without significant deviation. However, two ridges parallel the coast, one about one mile inland from the Indian River with elevations up to 30 feet, the other about 10 miles inland with similar elevations. All of the area west of the coastal ridges lies in the low and marshy St. John's River Valley. The coastal barrier islands have typical dune topography with dune elevations of about 15 feet.

The year 2000 population of Indian River County was reported as 112,947 (Reference 4) and the county population was estimated at 130,020 in 2006 (Reference 5). The population for the county grew by 214.8% in the last three decades of the 1900s. The majority of land in the county is devoted to agriculture, but retail trade was the largest of 20 major economic sectors in 2007. Residential, commercial, and industrial development occurs along the coastal barrier islands and the western shore of the Indian River. Indian River County is served by Interstate 95, U.S. Route 1, State Roads A-1-A, 60, and 5, and the Florida East Coast Railway.

The county seat of Indian River County is the City of Vero Beach, which is located along the Indian River on the coastal ridge approximately 123 miles north of the City of Hialeah, Florida. The year 2000 population for Vero Beach was reported as 17,705 (Reference 4). The City of Sebastian (population 16,181) is located north of Vero Beach on the same coastal ridge near the county boundary. The Town of Fellsmere (population 3,813) is located northwest of Vero Beach on the western coastal ridge. The Towns of Orchid (population 140) and Indian River Shores (population 3,448) are located on the coastal barrier islands of Indian River County (Reference 4).

The mainland drainage area is generally divided by the two geographic ridges that parallel the coast. The basin area between the ridges is generally low and relatively flat. Drainage of the northern portion of this basin area is provided by South Prong Creek and a network of manmade canals. The central and southern portions have essentially no natural watercourses. This area is drained by an extensive network of manmade canals and ditches that are interconnected and joined with Main Relief, North Relief, and South Relief Canals that discharge into the Indian River to the east.

Areas west of the inland ridge are relatively flat and drain westward to the St. John's River marshland, aided by extensive canals which have been constructed for agricultural use. This marshland is the origin of the St. John's River, the largest river in Florida. From its headwaters in Indian River County, the St. John's River flows northward for 310 miles to the Atlantic Ocean near the City of Jacksonville. The St. John's River has a basin of approximately 9,430 square miles.

The mainland for Indian River County is bordered on the east by the Indian River, a part of the Indian River Lagoon system. This 156-mile long estuary lies between the mainland and barrier islands from Volusia and Brevard Counties to the north, through Indian River County, and extending south to Palm Beach County. The Atlantic Intracoastal Waterway runs through the Indian River Lagoon for its length.

2.3 Principal Flood Problems

Floods can occur throughout the Indian River County area at any time during the year. However, they are most frequent during the rainy season from May to October. The streams and canals in the low area between the parallel ridges, as well as those that discharge into the St. John's River, are subject to flooding from prolonged heavy rainfall. Low, swampy, inland areas are also subject to flooding during wet periods.

Coastal areas of the county on the Atlantic Ocean are subject to storm surge flooding as a result of hurricane and tropical storm activity. Large tidal surges, combined with wave action and the heavy rainfall that accompanies these storms, have caused flooding. Areas along the Indian River experience flooding from tides caused by hurricane winds piling water against shorelines, causeways, and bridges.

There is considerable historical evidence of storms affecting the southeastern coast of the United States before the 20th century (Reference 6). On the Indian River, tide levels have been reported to be as high as 4.5 feet above mean sea level (msl) and wind speeds have reached 80 miles per hour. Tide levels in the Atlantic Ocean have been measured as high as 5 feet above msl on the open coast and 6 to 8 feet above msl inside the inlet at the City of Fort Pierce.

Some of the most significant late 20th and 21st century storms (Reference 7) that have affected the study area are described below.

November 13-16, 1994 – Tropical Storm Gordon moved over Florida, exiting just north of Vero Beach, and causing four deaths and 40 injuries and an estimated 400 million dollars of damage.

September 14-15, 1999 – Hurricane Floyd caused beach erosion, downed power lines, and damage to homes in coastal sections of Indian River County.

October 15-16, 1999 – Hurricane Irene caused minor damage to hundreds of homes and serious damage to about 50 homes in beach front communities in Indian River, Volusia, and Brevard Counties.

September 4, 2004 – Hurricane Frances caused an estimated 4.5 billion dollars in wind damage in Martin, St. Lucie, and Indian River Counties, washed out a beach road near Vero Beach, and caused significant inland flooding.

September 24-26, 2004 – Hurricane Jeanne damaged 49,300 residences in Indian River County and total wind damage was over 2 billion dollars.

August 19, 2008 – Tropical Storm Fay dropped 15–22 inches of rain in Indian River County, causing flooding of roads but no flood damage was reported.

2.4 Flood Protection Measures

Development in the 1-percent-annual-chance floodplain is controlled by local ordinance, based on a previous FEMA identification of flood hazard areas. Levees exist along the St. John's River that provide flood protection to the low-lying areas in the eastern portion of the historic floodplain. The area east of the St. John's River is divided into four major water control districts (WCDs) that are individually separated and protected from the adjacent areas with a series of continuous levees: the Fellsmere WCD, the Vero Lakes WCD, the Sebastian River WCD, and the Indian River Farms WCD.

Runoff from some of the WCDs is controlled by water control structures. Of the streams studied in detail, Main Relief Canal, North Relief Canal, and South Relief Canal in the Indian River Farms WCD have water control structures near the downstream ends of each canal. The water control structure on North Relief Canal is located approximately 200 feet downstream of County Highway 505. That structure has 3 radial gates. The water control structure on Main Relief Canal is located approximately 200 feet downstream of County Highway 611 and has 4 radial gates. The structure on South Relief Canal is located approximately 200 feet downstream of State Route 607 and has 3 radial gates. These structures are operated to maintain specified water levels in the canals. During flood events, the gates of the structures are expected to be fully open.

Levees exist in the study area that provide the community with some degree of protection against flooding. However, it has been ascertained that the primary levee system may not protect the community from rare events such as the 1-percent-annual-chance flood. The criteria used to evaluate protection against the 1-percent-annual-chance flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not protect against the 1-percent-annual-chance flood are not considered in the hydraulic analysis of the 1-percent-annual-chance floodplain.

A system of spoil banks and levees exists in the eastern floodplain of the Indian River. The flood frequencies versus stages in the USACE report (Reference 8) are computed as the elevations that would occur prior to any failure or overtopping of the primary levee system. It was recognized that the majority of the levees could be overtopped for such reasons as lack of adequate freeboard, substandard levee materials, and eroded crown elevations. In the USACE study, flood damage information was developed by failing levees to about 1 foot below the lowest crown elevation and routing flows to arrive at water-surface elevations on protected lands on the outside of the primary levees. The routed flood elevation for the reaches between State Road 60 and the northern county line was reported to be 21.4 feet North America Vertical Datum of 1988 (NAVD). That elevation is used in this FIS for mapping the land outside of the primary levees.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based

on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community, including both riverine and coastal sources.

The peak discharge-frequency relationships were calculated using a set of regression equations developed by the USGS (Reference 9) for all streams and canals studied in detail. USGS quadrangle maps and aerial photographs taken in 1984 were used to delineate drainage boundaries and compute hydrologic parameters, such as slopes and lake areas of basins.

Hydrologic calculations for new detailed riverine studies in this countywide revision were performed using the HEC-HMS computer program (Reference 10). These new detailed studies include: Collier Creek, Localized Flooding Area 1, Localized Flooding Area 2, Localized Flooding Area 3, Localized Flooding Area 4, and Schumann Waterway. The respective flooding sources were subdivided into areas and routing sections of sufficient detail so that frequency flows of 10%-, 2%-, 1%-, and 0.2%-annual chance could be calculated. In all flooding sources in this county, studied by this methodology, standard SCS methods were used as described in (References 11; 12), with the exception of using a peaking factor of 256 in lieu of the standard 484 peaking factor. This variation was adopted to account for the difference in terrain between the SCS default terrain and the terrain in Indian River County (gently rolling hills and flat with slight slopes, respectively).

Discharge data at North Relief, Main Relief, and South Relief Canals have been collected since 1952, 1950, and 1951, respectively. The annual peak discharges were analyzed using a log-Pearson Type III distribution, as outlined in Water Resources Council Bulletin 17B (Reference 13). The computed peak discharges at the gaging stations were compared with data obtained from regression equations for the ungaged sites and used to adjust the values, as outlined in USGS Water Resources Investigations Report 82-4012 (Reference 9).

Peak discharge-drainage area relationships for streams and canals studied by detailed methods are shown in Table 3, "Summary of Discharges."

Detailed hydrologic calculations for ponding flooding sources in this countywide revision were performed using the ICPR program (Reference 14). As with the riverine analyses revisions, standard SCS methodology was utilized. The stillwater elevations resulting from these calculations are presented below in Table 4, Summary of Ponding Stillwater Elevations.

Table 3: Summary of Discharges

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second)			
		10-percent	2-percent	1-percent	0.2-percent
COLLIER CREEK					
At confluence with South Prong Creek	2.27	628	947	1057	1345
Approximately 200 feet downstream of Collier Club Drive	2.11	633	879	978	1245
Approximately 1,050 feet downstream of Barber Street	0.79	361	495	549	693
ELKCAM WATERWAY/ COLLIER WATERWAY					
Just upstream of dam	6.20	245	455	565	865
At Periwinkle Drive	6.10	240	450	560	860
At Barber Street	5.80	240	445	560	860
About 10,700 feet downstream of Fellsmere Road	2.70	200	380	480	730
About 9,800 feet downstream of Fellsmere Road	2.00	160	315	400	620
About 4,300 feet downstream of Fellsmere Road	0.80	100	200	240	390
LATERAL G					
At confluence with North Relief Canal	4.60	365	580	735	1,150

Table 3: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second)			
		10-percent	2-percent	1-percent	0.2-percent
At 65th Street	2.70	225	405	505	820
At 69th Street	1.80	160	300	370	610
At 77th Street	1.10	120	220	275	475
At 81st Street	0.40	55	80	130	245
LATERAL H					
At confluence with North Relief Canal	2.50	215	390	480	780
At 49th Street	2.20	190	350	430	700
At 45th Street	1.30	125	250	300	525
At 41st Street	0.60	75	125	195	330
LATERAL J					
At confluence with North Relief Canal	5.20	405	640	805	1,255
At Oslo Road	4.00	320	520	665	1,045
About 2,700 feet upstream of Oslo Road	3.60	285	490	625	990
About 5,700 feet upstream of Oslo Road	2.70	220	405	505	820
At Southwest 21st Street	1.80	155	290	359	600

Table 3: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second)			
		10-percent	2-percent	1-percent	0.2-percent
LOCALIZED FLOODING AREA 1					
At confluence with Lateral J	0.85	314	435	485	615
Approximately 450 feet upstream of the confluence with Lateral J	0.47	283	392	436	552
Approximately 1,400 feet upstream of the confluence with Lateral J	0.44	269	372	413	525
LOCALIZED FLOODING AREA 2					
At 18 th Plaza Southwest	0.13	179	295	325	350
Approximately 800 feet upstream of 18 th Plaza Southwest	0.06	92	125	137	173
Approximately 1,700 feet upstream of 18 th Plaza Southwest	0.01	43	58	63	79
LOCALIZED FLOODING AREA 3					
At confluence with Localized Flooding Area 1	0.37	47	90	110	156
Approximately 3,300 feet upstream of the confluence with Localized Flooding Area 1	0.24	49	70	78	101

Table 3: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second)			
		10-percent	2-percent	1-percent	0.2-percent
LOCALIZED FLOODING AREA 4					
At 13 th Street Southwest	0.24	183	211	278	347
Approximately 1,900 feet upstream of 13 th Street Southwest	0.05	35	42	57	74
MAIN RELIEF CANAL					
At confluence	37.70	1,455	1,855	2,140	2,865
At U.S. Route 1	37.30	1,425	1,840	2,130	2,860
At 27th Avenue	35.10	1,325	1,760	2,075	2,840
Just upstream of control structure	33.80	1,260	1,710	2,030	2,820
At Kings Highway	28.70	1,005	1,525	1,875	2,765
About 4,800 feet upstream of Kings Highway	22.30	785	1,360	1,670	2,645
About 10,000 feet upstream of Kings Highway	20.90	725	1,290	1,595	2,570
NORTH RELIEF CANAL					
At confluence with Indian River	18.50	1,440	1,980	2,280	2,835
At Florida East Coast	17.90	1,390	1,920	2,230	2,790
At control structure	10.80	895	1,300	1,560	2,155

Table 3: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second)			
		10-percent	2-percent	1-percent	0.2-percent
SCHUMANN WATERWAY					
At confluence with Elkham Waterway	1.23	381	603	609	911
Approximately 175 feet downstream of Empress Avenue	1.03	334	445	495	731
Approximately 175 downstream of Schumann Drive	0.43	178	247	275	349
Approximately 2,900 feet upstream of Schumann Drive	0.16	103	246	163	210
SOUTH PRONG CREEK					
At U.S. Route 1	202.0	2,800	5,000	6,000	9,000
About 11,000 feet upstream of U.S. Route 1	80.80	1,950	3,400	4,150	6,100
About 16,200 feet upstream of U.S. Route 1	74.50	1,800	3,150	3,850	5,750
About 14,000 feet downstream of Fellsmere Road	69.10	1,750	3,050	3,700	5,550
At Fellsmere Road	56.50	1,500	2,600	3,200	4,800
About 4,000 feet upstream of Fellsmere Road	23.40	700	1,250	1,500	2,400

Table 3: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second)			
		10-percent	2-percent	1-percent	0.2-percent
SOUTH RELIEF CANAL					
At confluence	23.10	1,680	2,275	2,510	3,100
SOUTH RELIEF CANAL (Continued)					
At Old Dixie Highway	22.70	1,665	2,260	2,490	3,080
SOUTH RELIEF CANAL (Continued)					
About 3,400 feet upstream of Old Dixie Highway	17.50	1,370	1,930	2,215	2,885
About 3,700 feet upstream of Old Dixie Highway	16.10	1,270	1,810	2,065	2,685
About 100 feet downstream of 43rd Avenue	14.40	1,145	1,660	1,895	2,535
At 43rd Avenue	9.50	810	1,220	1,420	2,025
VERO LAKES CHANNEL A					
At confluence with South Prong Creek	31.50	900	1,600	1,960	3,050
At Wabasso Road	27.20	800	1,420	1,725	2,700
About 5,200 feet upstream of Wabasso Road	26.10	770	1,375	1,670	2,600

Table 3: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second)			
		10-percent	2-percent	1-percent	0.2-percent
VERO LAKES CHANNEL B					
At Wabasso Road	3.40	220	420	510	795
At 96th court	2.90	210	400	495	760
At 101st Avenue	1.40	130	260	330	520
VERO LAKES CHANNEL C					
At 90th Avenue	1.10	115	230	280	455
At 94th Avenue	0.70	90	180	225	360
At 98th Avenue	0.30	60	110	140	220
VERO LAKES CHANNEL D					
At 90th Avenue	11.40	350	610	775	1,210
At 102 Avenue	0.50	30	50	80	120

Table 4: Summary of Ponding Stillwater Elevations

Flooding Source	ELEVATION (FEET NAVD)			
	10-percent Annual Chance	2-percent Annual Chance	1-percent Annual Chance	0.2-percent Annual Chance
Millstone Landing 1	*	*	21.43	*
ML-1	*	*	21.43	*
ML-2	*	*	21.45	*
ML-3	*	*	21.24	*
ML-4	*	*	21.34	*
ML-5	*	*	20.73	*
ML-6	*	*	20.30	*
ML-7	*	*	20.88	*
ML-8	*	*	20.36	*
ML-9	*	*	19.66	*
ML-10	*	*	20.02	*
ML-11	*	*	19.95	*
ML-12	*	*	20.06	*
ML-13	*	*	20.15	*
ML-14	*	*	20.49	*
ML-15	*	*	21.61	*
ML-16	*	*	19.90	*
ML-17	*	*	19.79	*
ML-18	*	*	19.66	*
ML-19	*	*	20.00	*
ML-20	*	*	20.09	*
ML-21	*	*	21.29	*
ML-22	*	*	20.92	*
ML-23	*	*	20.47	*
ML-24	*	*	19.86	*
ML-25	*	*	22.05	*
ML-26	*	*	19.83	*
FT-1	*	*	21.02	*
P-1	*	*	18.86	*
P-2	*	*	17.84	*
P-3	*	*	17.62	*
SL-1	*	*	20.46	*

Flooding Source	ELEVATION (FEET NAVD)			
	10-percent Annual Chance	2-percent Annual Chance	1-percent Annual Chance	0.2-percent Annual Chance
SL-2	*	*	19.47	*
SL-4	*	*	19.47	*
SL-5	*	*	19.68	*
SL-6	*	*	20.06	*
SL-7	*	*	20.24	*
SL-8	*	*	20.60	*
SL-9	*	*	20.31	*
SL-10	*	*	20.33	*
SL-11	*	*	20.38	*
SL-12	*	*	21.13	*
SL-13	*	*	19.62	*
SL-14	*	*	19.70	*
SL-15	*	*	19.59	*
SL-17	*	*	15.26	*
SL-18	*	*	18.55	*
SL-19	*	*	19.58	*
SL-20	*	*	19.19	*
SH-1	*	*	21.91	*
SH-2	*	*	22.36	*
SH-3	*	*	22.11	*
SH-4	*	*	21.93	*
SH-5	*	*	21.66	*
SH-6	*	*	21.55	*
SH-7	*	*	21.48	*
SH-8	*	*	21.36	*
SH-9	*	*	21.16	*
SH-10	*	*	20.36	*
SH-11	*	*	20.76	*
SH-12	*	*	21.67	*
SH-13	*	*	23.24	*

*Data not calculated

Inundation from the Atlantic Ocean caused by passage of storms (storm surge) was determined by the joint probability method (Reference 15). The storm populations were described by probability distributions of five parameters that influence surge heights. These parameters were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were statistically described based on an analysis of observed storms in the vicinity of Indian River County. Primary sources of data for this analysis were "Tropical Cyclones of the North Atlantic Ocean;" "Some Climatological Characteristics of Hurricanes and Tropical Storms, Gulf and East Coasts of the United States;" and "Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Windfields, Gulf and East Coasts of the United States;" all prepared by the National Oceanic and Atmospheric Administration (NOAA) (References 16; 17; 18). A summary of the parameters used for the area is presented in Table 5, "Parameter Values for Surge Elevations."

Table 5: Parameter Values for Surge Elevations

Parameter	Assigned Values							
Central pressure depression (millibars)	18.9	32.6	46.4	60.1	73.9	87.6	101.4	115.1
Probability ¹	0.274	0.358	0.181	0.092	0.047	0.024	0.012	0.012
Storm radius to maximum winds (nautical miles)	13.0				28.0			
Probability	0.433				0.567			
Forward speed (knots)	7.5			16.5			25.5	
Probability ²	0.533			0.413			0.054	
Direction of storm path (degrees from true north)	47.0		111.0		174.0		238.0	
Probability ²	0.036		0.222		0.353		0.389	
Frequency of storm occurrence (storm/nautical mile/year)	0.00455							

¹ Average of entering, alongshore, and exiting

² Probabilities for entering

For areas subject to flooding directly from the Atlantic Ocean, the FEMA standard storm surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the five storm parameters defined previously). By performing such simulations for a large number of storms, each of known total probability, the frequency distribution of surge height can be established as a function of coastal location. These

distributions incorporate the large-scale surge behavior, but do not include an analysis of the added effects associated with much finer scale wave phenomena, such as wave height or runup. As the final step in the calculations, the astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total water level (Reference 19).

Wave setup was determined to significantly contribute to the total stillwater flood levels along the Atlantic Ocean coast. The amount of wave setup was calculated using methodology outlined in the USACE "Shore Protection Manual" (Reference 20).

The storm-surge elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods have been determined for Indian River County and are shown in Table 6, "Summary of Coastal Stillwater Elevations." Wave heights and corresponding wave crest elevations were determined in accordance with the "Users Manual for Wave Action Effects Associated with Storm Surges" (Reference 21).

Table 6: Summary of Coastal Stillwater Elevations

Flooding Source and Transect	Flood Insurance Rate Map Panel	Stillwater Elevation (Feet NAVD)				Zone	Base Flood Elevation (Feet NAVD) ^{1,2}
		10-percent annual-chance	2-percent annual-chance	1-percent annual-chance	0.2-percent annual-chance		
ATLANTIC OCEAN							
1	0102	2.8	5.0	8.1 ³	8.3	VE	11–14 ⁴
						AE	9–11
		2.8	5.0	5.9	8.3	VE	9–11
						AE	6–8
2	0102	2.9	5.0	8.2 ³	8.3	VE	11–14 ⁴
						AE	9–11
		2.9	5.0	6.0	8.3	VE	9–11
						AE	6–8
3	0102, 0106	2.8	5.0	8.2 ³	8.3	VE	11–14 ⁴
						AE	9–11
		2.8	5.0	6.0	8.3	VE	9–11
						AE	6–8
4	0108	2.8	5.0	8.2 ³	8.3	VE	11–14 ⁴
						AE	9–11
		2.8	5.0	6.0	8.3	VE	9–11
						AE	6–8
5	0108	2.7	5.0	8.2 ³	8.3	VE	11–14 ⁴
						AE	9–11
		2.7	5.0	6.0	8.3	VE	9–11
						AE	6–8

Table 6: Summary of Coastal Stillwater Elevations (continued)

Flooding Source and Transect	Flood Insurance Rate Map Panel	Stillwater Elevation (Feet NAVD)				Zone	Base Flood Elevation (Feet NAVD) ^{1,2}
		10-percent annual-chance	2-percent annual-chance	1-percent annual-chance	0.2-percent annual-chance		
ATLANTIC OCEAN							
(continued)							
6	0108	2.7	4.8	7.9 ³	8.3	VE	11–14 ⁴
						AE	9–11
		2.7	4.8	5.8	8.3	VE	9–11
						AE	6–8
7	0116	2.7	4.8	7.9 ³	8.1	VE	11–14 ⁴
						AE	9–11
		2.7	4.8	5.8	8.1	VE	9–11
						AE	6–8
8	0116	2.7	4.8	7.9 ³	8.1	VE	15 ⁴
9	0116	2.6	4.8	7.9 ³	8.1	VE	15 ⁴
10	0117	2.6	4.8	7.9 ³	8.1	VE	15 ⁴
11	0119	2.6	4.8	7.9 ³	8.0	VE	15 ⁴
12	0119	2.6	4.8	7.9 ³	8.0	VE	15 ⁴
13	0232	2.6	4.7	7.8 ³	8.0	VE	16 ⁴
14	0232	2.6	4.7	7.8 ³	7.9	VE	16 ⁴
15	0232, 0251	2.6	4.6	7.7 ³	7.8	VE	16 ⁴
16	0253	2.6	4.7	7.8 ³	7.8	VE	16 ⁴
17	0261	2.6	4.7	7.8 ³	7.8	VE	16 ⁴
18	0261	2.6	4.7	7.7 ³	7.7	VE	16 ⁴

Table 6: Summary of Coastal Stillwater Elevations (continued)

Flooding Source and Transect	Flood Insurance Rate Map Panel	Stillwater Elevation (Feet NAVD)				Zone	Base Flood Elevation (Feet NAVD) ^{1,2}
		10-percent annual-chance	2-percent annual-chance	1-percent annual-chance	0.2-percent annual-chance		
ATLANTIC OCEAN							
(continued)							
19	0261, 0263	2.6	4.7	7.6 ³	7.7	VE	16 ⁴
20	0263	2.6	4.6	7.6 ³	7.6	VE	16 ⁴
21	0263	2.6	4.6	7.8 ³	7.6	VE	15–16 ⁴
22	0263	2.6	4.6	7.7 ³	7.6	VE	12–13 ⁴
23	0376, 0377	2.6	4.6	7.7 ³	7.6	VE	13 ⁴
24	0377	2.6	4.6	7.8 ³	7.6	VE	13 ⁴
25	0379	2.5	4.5	7.6 ³	7.4	VE	14 ⁴
26	0379	2.5	4.5	7.6 ³	7.4	VE	14 ⁴
INDIAN RIVER							
27	0101, 0102	1.8	3.1	3.7	5.1	AE	4–6
28	0102	2.0	3.4	4.0	5.4	AE	4–6
29	0102, 0104	2.1	3.4	4.1	5.6	AE	5–7
30	0104, 0108	2.6	4.1	4.9	6.7	AE	5–7
						VE	7–8
31	0104, 0108	2.6	4.3	5.0	6.8	AE	5–7
						VE	8
						AE	5
		1.4	3.3	4.2	6.0	AE	

Table 6: Summary of Coastal Stillwater Elevations (continued)

Flooding Source and Transect	Flood Insurance Rate Map Panel	Stillwater Elevation (Feet NAVD)				Zone	Base Flood Elevation (Feet NAVD) ^{1,2}
		10-percent annual-chance	2-percent annual-chance	1-percent annual-chance	0.2-percent annual-chance		
INDIAN RIVER							
(continued)							
32	0108, 0112, 0116	2.7	4.5	5.3	7.2	AE	6-8
						VE	8
		2.7	4.2	4.3	6.2	AE	5
33	0112, 0116	2.9	4.7	5.5	7.5	AE	6-8
						VE	8
		2.9	4.1	4.9	6.8	AE	5
34	0112, 0116	2.9	3.8	5.6	7.8	AE	6-8
		2.9	3.8	4.5	7.8	AE	5
35	0116	2.9	3.8	5.7	7.8	AE	6-8
		2.9	4.5	6.1	6.5	AE	6
36	0116	3.0	5.0	5.8	8.0	AE	6-8
		3.0	5.1	6.2	7.2	AE	7
37	0118	3.3	5.8	6.3	8.5	AE	7-9
38	0118, 0119	3.3	5.5	6.5	8.8	VE	9
						AE	7-9
39	0118, 0119	3.3	5.5	6.5	8.8	AE	7-9
40	0118, 0119	3.4	5.2	6.0	7.8	AE	7-8
		3.4	5.4	6.3	8.2	AE	7
41	0118, 0119, 0231	3.6	5.4	6.0	7.7	AE	7-8
		3.5	5.8	6.2	6.8	AE	7

Table 6: Summary of Coastal Stillwater Elevations (continued)

Flooding Source and Transect	Flood Insurance Rate Map Panel	Stillwater Elevation (Feet NAVD)				Zone	Base Flood Elevation (Feet NAVD) ^{1,2}
		10-percent annual-chance	2-percent annual-chance	1-percent annual-chance	0.2-percent annual-chance		
INDIAN RIVER							
(continued)							
42	0231, 0232	3.6	5.3	6.0	7.4	AE	6–8
43	0232	3.6	5.4	6.1	7.7	AE	7–8
		3.4	4.8	5.4	6.9	AE	6
44	0232, 0234	3.5	5.8	6.2	6.9	AE	7
		3.5	5.2	5.8	7.3	AE	7–8
45	0234, 0253	3.6	5.3	6.0	7.2	AE	6–8
46	0242, 0261	3.0	4.8	5.5	7.2	AE	6–8
47	0242, 0261	2.6	3.9	4.7	6.1	AE	5–6
48	0263	2.5	4.1	4.9	6.4	AE	7
		2.4	4.1	4.8	6.4	AE	5–6
49	0263	2.5	4.3	5.1	6.4	AE	6–7
		2.5	4.3	5.0	6.8	AE	5
50	0263	2.4	4.1	4.8	6.4	AE	5–7
51	0263	2.2	4.0	4.6	5.7	AE	5–7
52	0376	1.9	3.5	4.1	5.6	AE	4–6
53	0376, 0377	1.6	3.0	3.5	5.0	AE	4–5
54	0379	1.3	2.6	3.3	3.8	AE	4–5

Table 6: Summary of Coastal Stillwater Elevations (continued)

Flooding Source and Transect	Flood Insurance Rate Map Panel	Stillwater Elevation (Feet NAVD)				Zone	Base Flood Elevation (Feet NAVD) ^{1,2}
		10-percent annual-chance	2-percent annual-chance	1-percent annual-chance	0.2-percent annual-chance		
INDIAN RIVER							
(continued)							
55	0379	1.2	2.8	3.2	4.3	AE	4
		1.3	2.5	3.0	4.2	AE	4-5
56	0101	2.1	3.6	4.2	5.6	AE	5-7
57	0101, 0102, 0103	2.2	3.7	4.4	5.8	AE	5-7
		2.4	4.0	4.7	6.2	AE	5-7
58	0103, 0104	2.4	4.0	4.7	6.2	AE	5-7
59	0103, 0104	2.4	4.0	4.7	6.2	VE	5-7
						AE	7
60	0103, 0104	2.8	4.6	5.4	7.1	AE	6-8
						VE	8
61	0112	3.0	4.8	5.7	7.4	AE	6-8
62	0112	2.9	5.1	6.0	7.9	AE	6-8
						VE	8
63	0112	3.0	5.0	5.8	8.0	AE	6-8
64	0112, 0114	3.1	5.2	6.2	8.3	AE	7-8
		3.1	5.1	6.0	8.2	AE	7
65	0114, 0118	3.3	5.8	6.3	8.7	AE	7-9
66	0114, 0118	3.6	5.6	6.7	8.9	AE	7-9
67	0118	3.6	5.6	6.7	8.9	AE	7-9

Table 6: Summary of Coastal Stillwater Elevations (continued)

Flooding Source and Transect	Flood Insurance Rate Map Panel	Stillwater Elevation (Feet NAVD)				Zone	Base Flood Elevation (Feet NAVD) ^{1,2}
		10-percent annual-chance	2-percent annual-chance	1-percent annual-chance	0.2-percent annual-chance		
68	0118, 0231	3.4	5.0	5.7	7.1	AE	7-8
		3.4	5.8	6.2	6.5	AE	7
69	0231	3.6	5.3	6.0	7.4	AE	6-8
70	0231	3.6	5.4	6.1	7.6	AE	7-8
71	0233, 0234	3.2	5.2	6.0	7.7	AE	6-8
72	0234	3.3	5.1	5.8	7.3	AE	6-8
73	0242	3.0	4.8	5.5	7.2	AE	6-7
74	0242	2.6	4.1	4.7	6.1	AE	5-6
75	0244, 0263	2.5	4.2	4.9	6.5	AE	5-7
76	0244, 0263	2.5	4.3	5.0	6.8	AE	5-7
77	0244, 0263	2.4	4.4	5.1	6.9	AE	6-7
		2.4	4.1	4.8	6.4	AE	5
78	0244, 0263	2.4	4.2	4.8	6.7	AE	5-7
79	0357, 0376	1.9	3.5	4.1	5.6	AE	5-6
		1.9	2.9	3.5	4.9	AE	4
80	0359, 0376, 0378	1.6	2.7	3.5	4.9	AE	4-5
81	0378	1.5	2.7	3.2	4.3	AE	4-5

Table 6: Summary of Coastal Stillwater Elevations (continued)

Flooding Source and Transect	Flood Insurance Rate Map Panel	Stillwater Elevation (Feet NAVD)				Zone	Base Flood Elevation (Feet NAVD) ^{1,2}
		10-percent annual-chance	2-percent annual-chance	1-percent annual-chance	0.2-percent annual-chance		
INDIAN RIVER							
(continued)							
82	0390	1.4	2.7	3.3	4.8	AE	4-5

¹ Rounded to the nearest foot and may include effects of wave action

² Due to map scale limitations, base flood elevations shown on map may represent average elevations for the zones depicted

³ Includes the effects due to wave setup

⁴ Includes the effects due to wave runup

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Cross sections for the backwater analyses were obtained from field surveys (References 22; 23) and USGS topographic maps and municipal topographic maps (References 24; 25) were used to extend surveyed cross sections in some cases. All bridges and culverts were field checked to obtain elevation data and structural geometry of waterway crossings.

Locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a Floodway was computed, selected cross-section locations are also shown on the FIRM (Exhibit 2).

For the streams studied in detail (except as identified below), water-surface elevations for floods of the selected recurrence intervals were developed using the HEC-2 step-backwater computer program (Reference 26). Starting water-surface elevations were obtained using the slope-area method. Independent computations were performed to determine flood levels along the rivers resulting from either coastal flooding or rainfall.

Collier Creek, Localized Flooding Area 1, Localized Flooding Area 2, Localized Flooding Area 3, Localized Flooding Area 4, and Schumann Waterway water surface elevations were calculated using the HEC-RAS computer program (Reference 27). Starting water surface elevations were obtained from normal depth calculations.

Channel roughness factors (Manning's "n" values) used in the hydraulic computations were chosen by engineering judgment on the basis of field observation and aerial photographs of the streams and floodplain areas (References 28; 29; 30). Channel and overbank "n" values for the streams studied by detailed methods are shown in Table 7, "Summary of Roughness Coefficients."

Table 7: Summary of Roughness Coefficients

Flooding Source	Roughness Coefficients	
	Channel "n"	Overbanks "n"
Collier Creek	0.035 – 0.055	0.060 – 0.120
Elkcam Waterway/Collier Waterway	0.040 – 0.050	0.070 – 0.090

Table 7: Summary of Roughness Coefficients (continued)

Flooding Source	Roughness Coefficients	
	Channel “n”	Overbanks “n”
Lateral G	0.035 – 0.055	0.060 – 0.090
Lateral H	0.035 – 0.055	0.070 – 0.080
Lateral J	0.040 – 0.055	0.070 – 0.080
Localized Flooding Area 1	0.033	0.020 – 0.100
Localized Flooding Area 2	0.033 – 0.045	0.070 – 0.110
Localized Flooding Area 3	0.033 – 0.050	0.070 – 0.100
Localized Flooding Area 4	0.035 – 0.045	0.050 – 0.100
Main Relief Canal	0.035 – 0.045	0.060 – 0.090
North Relief Canal	0.035 – 0.050	0.050 – 0.070
Schumann Waterway	0.035	0.090 – 0.140
South Prong Creek	0.040 – 0.050	0.070 – 0.090
South Relief Canal	0.035 – 0.055	0.060 – 0.120
Vero Lakes Channel A	0.040 – 0.060	0.040 – 0.090
Vero Lakes Channel B	0.035 – 0.045	0.060 – 0.080
Vero Lakes Channel C	0.035 – 0.045	0.070
Vero Lakes Channel D	0.035 – 0.040	0.060 – 0.070

The 1-percent-annual-chance frequency flood profile for the St. John's River was taken from the USACE General Design Memorandum for the Upper St. Johns River Basin, Supplement 2 (Reference 8). The flood profiles of the 10-, 4-, 2-, and 1-percent-annual-chance frequencies and Standard Project Flood were computed using the HEC-1 and CHANOP models presented in the General Design Memorandum.

Areas of the community protected by levees are subject to potential risk due to possible failure or overtopping of the levee. These areas were delineated by applying the 1-percent-annual-chance elevation determined from the "levee in place" analysis.

Except for the first 1,000 feet of the Elkcam Waterway-Collier Waterway from the mouth at South Prong Creek, each stream is assumed to have a hydraulic baseline coincident with its streamline.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Hydraulic analyses were carried out to provide estimates of the elevations of floods of the selected recurrence intervals caused by storm surge along each of the shorelines. These analyses considered storm characteristics and the shoreline and bathymetric characteristics of the flooding sources.

For areas subject to flooding directly from the Atlantic Ocean, the FEMA standard coastal surge model (Reference 19) was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the five storm parameters previously defined). Performing such simulations for a large number of storms, each of known total probability, permits one to establish the frequency distribution of surge height as a function of coastal location. These distributions incorporate the large scale surge behavior, but do not include an analysis of the added effects associated with much finer scale wave phenomena such as wave height, setup, or runup. The astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total water level.

The FEMA storm surge model was used to simulate the hydrodynamic behavior of the surge generated by the various synthetic storms. This model utilizes a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed utilizing grids of 5 by 5 nautical miles and 0.5 by 0.5 nautical mile, depending on the resolution required.

Water depths and land heights for the model grid systems were obtained from NOAA bathymetric maps at a scale of 1:25,000 (Reference 31), and, for near shore areas, from NOAA hydrographic surveys (Reference 32). Water depths for the embedded river modeling were obtained from NOAA nautical charts (Reference 33). Land elevations for the models were obtained from USGS topographic maps; FDNR "Indian River County Beach Profiles;" FDOT "Coastal Construction Control Line Aerials for Indian River County, Florida;" and a Drainage Study Map of Vero Beach (References 24; 34; 35; 25).

Friction factors (Manning's "n") for inland areas were chosen based on USGS topographic maps (Reference 24), drainage study maps of Vero Beach (Reference 25), aerial photographs (Reference 35) and field inspection.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (NAS) (Reference 36). This method is based on the following major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in the NAS report (Reference 36). The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Transects (cross-section lines), illustrated in Figure 1, "Transect Location Map," were located along the coastal areas. The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at large intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Wave heights were computed along transects in accordance with the "Users Manual for Wave Height Analysis" (Reference 21). Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 1-percent-annual-chance flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave was computed at each transect and used to determine the terminus of the V zone (area with velocity wave action). Along the open coast, the V zone designation was applied to all areas seaward of the heel of the primary dune system. Dune erosion along the Atlantic Ocean coastline of Indian River County was taken into account. The amount of dune erosion was calculated using the methodology outlined in "Guidelines and Specifications for Wave Elevation Determination" (Reference 37).

Figure 2 represents a sample transect that illustrates the relationship between the stillwater elevation, the wave crest elevation, the ground elevation profile, and the location of the V/A zone boundary.

Table 8 provides a listing of the transect locations, stillwater starting elevations, and initial wave crest elevations.

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic maps (Reference 24), beach profiles (Reference 34), aerial surveys (Reference 38), and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

In addition to the wave height analysis, wave runup was computed along the Atlantic Ocean coastline of Indian River County using the methodology presented in the "Manual for Wave Runup Analysis, Coastal Flood Insurance Studies" (Reference 39).

For base flood elevations (BFEs) for transects, refer to Table 6, "Summary of Coastal Stillwater Elevations." All elevations are referenced to the NAVD.

INDIAN RIVER COUNTY COASTAL TRANSECTS

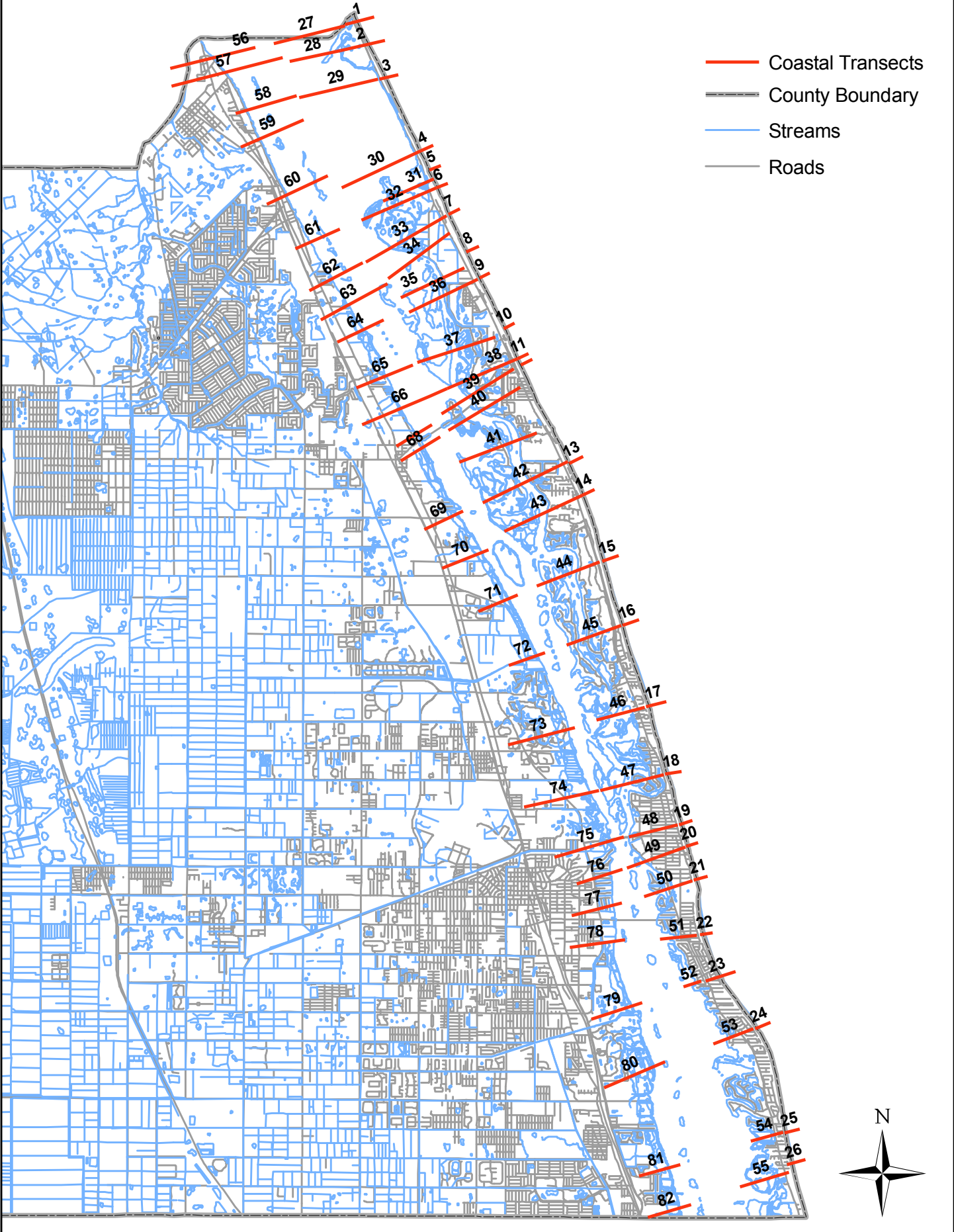


Figure 2: Transect Schematic

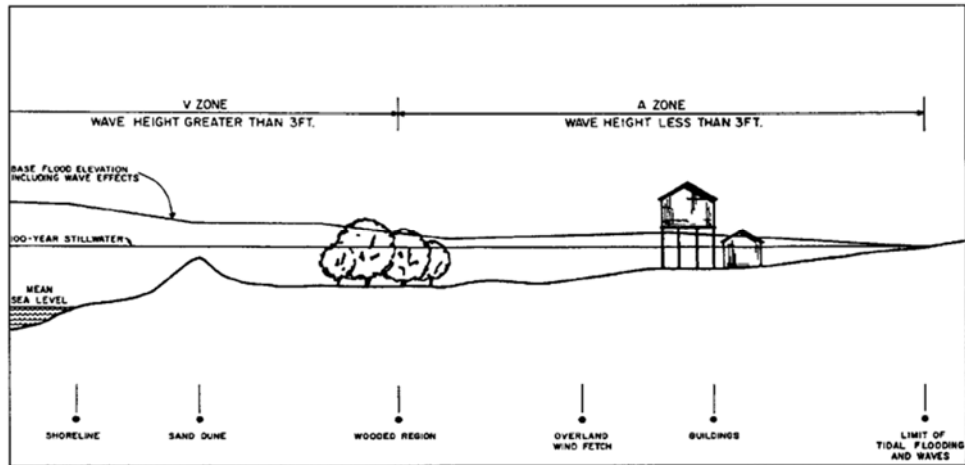


Table 8: Transect Locations, Stillwater Starting Elevations, and Initial Wave Crest Elevations

Transect	Location	1-Percent-Annual-Chance Elevation (Feet NAVD)	
		Stillwater	Wave Crest
1	From the Atlantic coastline, approximately 500 feet south of State Road A-1-A bridge over Sebastian Inlet, extending west	5.93	9.93
2	From the Atlantic coastline, approximately 2,700 feet south of State Road A-1-A bridge over Sebastian Inlet, extending west	6.00	10.03
3	From the Atlantic coastline, approximately 1.2 miles south of State Road A-1-A bridge over Sebastian Inlet, extending west	6.00	10.03
4	From the Atlantic coastline, approximately 2.6 miles south of State Road A-1-A bridge over Sebastian Inlet, extending west	6.01	10.05
5	From the Atlantic coastline, approximately 2,900 feet north of intersection of Jungle Trail and State Road A-1-A, extending west	6.01	10.05

**Table 8: Transect Locations, Stillwater Starting Elevations,
and Initial Wave Crest Elevations (continued)**

Transect	Location	1-Percent-Annual-Chance Elevation (Feet NAVD)	
		Stillwater	Wave Crest
6	From the Atlantic coastline, approximately 1,300 feet north of intersection of Jungle Trail and State Road A-1-A, extending west	5.79	9.71
7	From the Atlantic coastline, approximately 1,600 feet south of intersection of Jungle Trail and State Road A-1-A, extending west	5.79	9.71
8	From the Atlantic coastline, approximately 1.0 mile south of intersection of Jungle Trail and State Road A-1-A, extending west	5.75	9.65
9	From the Atlantic coastline, approximately 1.5 miles south of intersection of Jungle Trail and State Road A-1-A, extending west	5.75	9.65
10	From the Atlantic coastline, approximately 1.3 miles north of intersection of County Highway 510 and State Road A-1-A, extending west	5.75	9.65
11	From the Atlantic coastline, approximately 3,900 feet north of intersection of County Highway 510 and State Road A-1-A, extending west	5.69	9.56
12	From the Atlantic coastline, approximately 3,200 feet north of intersection of County Highway 510 and State Road A-1-A, extending west	5.69	9.56
13	From the Atlantic coastline, approximately 1.3 miles south of intersection of County Highway 510 and State Road A-1-A, extending west	5.60	9.42
14	From the Atlantic coastline, approximately 1.9 miles south of intersection of County Highway 510 and State Road A-1-A, extending west	5.59	9.40
15	From the Atlantic coastline, approximately 3,400 feet south of intersection of Snook Alley and State Road A-1-A, extending west	5.54	9.32
16	From the Atlantic coastline, approximately 0.9 mile north along State Road A-1-A from Poloma Drive, extending west	5.57	9.37

Table 8: Transect Locations, Stillwater Starting Elevations, and Initial Wave Crest Elevations (continued)

Transect	Location	1-Percent-Annual-Chance Elevation (Feet NAVD)	
		Stillwater	Wave Crest
17	From the Atlantic coastline, approximately 1,400 feet north along State Road A-1-A from intersection of Indian Lane and State Road A-1-A, extending west	5.56	9.35
18	From the Atlantic coastline, approximately 900 feet south along State Road A-1-A from Bahia Mar Drive in Vero Beach, extending west	5.48	9.23
19	From the Atlantic coastline, approximately 1,000 feet north along State Road A-1-A from Beachland Boulevard in Vero Beach, extending west	5.46	9.20
20	From the Atlantic coastline, approximately 950 feet south along State Road A-1-A from State Road 60 in Vero Beach, extending west	5.46	9.20
21	From the Atlantic coastline, approximately 4,200 feet south along State Road A-1-A from Beachland Boulevard, extending west	5.56	9.35
22	From the Atlantic coastline, at intersection of State Road A-1-A and Pirate Cove Lane, extending west	5.55	9.34
23	From the Atlantic coastline, approximately 600 feet south along State Road A-1-A from Shorewinds Lane, extending west	5.54	9.32
24	From the Atlantic coastline, approximately 2,200 feet north along State Road A-1-A from Sears Cove Road, extending west	5.57	9.37
25	From the Atlantic coastline, approximately 800 feet south along State Road A-1-A from Windward Way Road, extending west	5.44	9.17
26	From the Atlantic coastline, approximately 2,100 feet south along State Road A-1-A from St. Christopher Lane, extending west	5.42	9.14
27	From the Indian River east bank, approximately 1,500 feet southwest of State Road A-1-A bridge over Sebastian Inlet (following along shoreline), extending east	3.72	5.69

**Table 8: Transect Locations, Stillwater Starting Elevations,
and Initial Wave Crest Elevations (continued)**

Transect	Location	1-Percent-Annual-Chance Elevation (Feet NAVD)	
		Stillwater	Wave Crest
28	From the Indian River east bank at Coconut Point, approximately 3,900 feet southwest (following shoreline) from bridge crossing Sebastian Inlet, extending east	4.02	5.97
29	From the Indian River east bank, approximately 1.2 miles southwest of State Road A-1-A bridge along east bank shoreline, extending east	4.13	6.25
30	From the Indian River east bank, approximately 2.6 miles south (following shoreline) of State Road A-1-A bridge over Sebastian Inlet, extending east	4.90	7.29
31	From the Indian River east bank, 2,200 feet south of Black Point along east shoreline of mangrove island, extending east	5.05	7.28
32	From the Indian River east bank, approximately 1,200 feet north of place called Green Point, on mangrove island near Turtle Pen Slough, extending east	5.31	7.45
33	From the Indian River east bank, at Spratt Point along mangrove shoreline south of Turtle Pen Slough, extending east	5.51	7.68
34	From the Indian River east bank, approximately 2,800 feet southeast from Spratt Point along east shoreline near Egret Islands, extending northeast	5.61	7.71
35	From the Indian River east bank, on east shoreline of Roosevelt Island, approximately 400 feet south of tip of island, extending east	5.68	7.37
36	From the Indian River east bank, approximately 1,800 feet south of northwest tip of Horseshoe Island, on west shoreline of island, extending east	5.83	7.84
37	From the Indian River east bank, approximately 3,600 feet north of place called South Point on Preacher's Island, on west shoreline of island, extending northeast	6.25	8.15

**Table 8: Transect Locations, Stillwater Starting Elevations,
and Initial Wave Crest Elevations (continued)**

Transect	Location	1-Percent-Annual-Chance Elevation (Feet NAVD)	
		Stillwater	Wave Crest
38	From the Indian River east bank, at East Channel, approximately 2,400 feet north of County Highway 510 bridge, on east shoreline near small lagoon, extending northeast	6.51	8.82
39	From the Indian River east bank, on west shoreline of Wabasso Island, approximately 800 feet north of County Highway 510 bridge onto Wabasso Island, extending northeast	6.51	8.51
40	From the Indian River east bank, on west shoreline of Wabasso Island, approximately 600 feet south of County Highway 510 bridge onto Wabasso Island, extending northeast	6.04	7.86
41	From the Indian River east bank, south of Wabasso Island, along east shoreline of mangrove island, extending east	5.89	7.48
42	From the Indian River east bank, on west shoreline of Pine Island, 100 feet north of north Indian River Shores corporate limit, extending east	5.97	7.66
43	From the Indian River east bank, on west shoreline of Pine Island, approximately 3,200 feet north of south tip of island, extending east	6.09	7.80
44	From Indian River Narrows east bank, on west shoreline of Barker Island, approximately 1,800 feet north of south tip of island, extending east	5.85	7.67
45	From Indian River Narrows east bank, on west shoreline of Johns Island, approximately 3,400 feet north of Pople Point, extending east	5.76	7.44
46	From Indian River Narrows east bank, approximately 1,500 feet north of north bank of McCullers Cove, extending east	5.50	6.70
47	From Indian River Narrows east bank, on west shoreline of mangrove island, just above Fritz Island, approximately 1,000 feet north of south tip of mangrove island, extending east	4.71	5.65

**Table 8: Transect Locations, Stillwater Starting Elevations,
and Initial Wave Crest Elevations (continued)**

Transect	Location	1-Percent-Annual-Chance Elevation (Feet NAVD)	
		Stillwater	Wave Crest
48	From Indian River Narrows east bank, approximately 600 feet north of State Road 60 bridge, extending east	4.92	6.15
49	From the Indian River east bank, on west shoreline of Farley Island, approximately 600 feet south of north tip of island, extending east	5.03	6.39
50	From the Indian River east bank, approximately 200 feet north of south tip of island on north side of North Creek, extending east	4.77	6.35
51	From the Indian River east bank, at Erwin Cove, approximately 300 feet north of Lantana Lane, extending east	4.66	6.43
52	From the Indian River east bank, at Hells Pocket, approximately 500 feet north of Little Harbor Lane, extending east	4.07	5.69
53	From the Indian River east bank, north of Little Starvation Cove, 800 feet south of Osprey Court, extending east	3.50	5.03
54	From the Indian River east bank, at Head Cove, 1,000 feet south of Spy Glass Lane, extending east	3.31	4.81
55	From the Indian River east bank, approximately 1,500 feet north of north tip of Round Island, extending east	3.03	4.42
56	From the Indian River west bank, approximately 1,300 feet south of U.S. Route 1 bridge over Sebastian Inlet, extending west	4.24	6.23
57	From the Indian River west bank, approximately 1,350 feet south of Palm Lane, extending west	4.41	6.38
58	From the Indian River west bank, approximately 3,500 feet south of intersection of Roseland Road and Indian River Drive, extending west	4.68	6.73

**Table 8: Transect Locations, Stillwater Starting Elevations,
and Initial Wave Crest Elevations (continued)**

Transect	Location	1-Percent-Annual-Chance Elevation (Feet NAVD)	
		Stillwater	Wave Crest
59	From the Indian River west bank, approximately 4,700 feet north of intersection of Main Street and Riverside Avenue, extending west	4.68	6.90
60	From the Indian River west bank, approximately 650 feet north of intersection of County Highway 512 and Riverside Avenue, extending west	5.40	7.89
61	From the Indian River west bank, approximately 2,600 feet south of intersection of County Highway 512 and Riverside Avenue, extending west	5.69	7.75
62	From the Indian River west bank, approximately 2,100 feet south of intersection of Riverside Avenue and U.S. Route 1, extending west	6.01	7.91
63	From the Indian River west bank, approximately 5,000 feet south of intersection of Riverside Avenue and U.S. Route 1, extending west	5.83	7.62
64	From the Indian River west bank, approximately 800 feet north of Duck Point, extending west	5.98	8.99
65	From the Indian River west bank, approximately 3,900 feet south of Duck Point, extending west	6.35	8.25
66	From the Indian River west bank, approximately 3,400 feet north along U.S. Route 1 from County Highway 510 bridge, extending west	6.66	9.97
67	From the Indian River west bank, approximately 700 feet north of County Highway 510 bridge along shoreline, extending west	6.66	8.66
68	From the Indian River west bank, approximately 600 feet south of County Highway 510 bridge along shoreline, extending west	5.66	7.48

Transect	Location	1-Percent-Annual-Chance Elevation (Feet NAVD)	
		Stillwater	Wave Crest
71	From Indian River Narrows west bank, approximately 1,100 feet north(along shoreline) of Quay Dock Road, extending west	5.85	7.67
72	From Indian River Narrows west bank, approximately 4,700 feet south(along shoreline) of Quay Dock Road, extending west	5.76	7.44
73	From Indian River Narrows west bank, approximately 1,800 feet north of foot of 45th Street, extending west	5.50	6.75
74	From Indian River Narrows west bank, approximately 4,200 feet south of foot of 45th Street, extending west	4.71	5.65
75	From Indian River Narrows west bank, approximately 850 feet north of State Road 60 bridge, extending west	4.92	6.15
76	From the Indian River west bank, approximately 2,200 feet south of State Road 60 bridge, or approximately 150 feet south of mouth of second canal south of State Road 60 bridge, extending west	5.03	6.39
77	From the Indian River west bank, approximately 1,300 feet north of State Road 656, extending west	4.77	6.35
78	From the Indian River west bank, approximately 2,000 feet south of State Road 656, extending west	4.81	6.58
79	From the Indian River west bank, approximately 900 feet north of mouth of South Canal in Vero Beach, extending west	4.13	5.75
80	From the Indian River west bank, approximately 1,300 feet north of Crawford Point, or approximately 5,000 feet south of South Canal, extending west	3.54	5.07
81	From the Indian River west bank, approximately 1.2 miles south of Oslo Road, extending west	3.23	4.75
82	From the Indian River west bank, approximately 650 feet south of Southeast 23rd Street, extending west	3.16	4.55

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Because the elevations in the May 1989 study were referenced to the National Geodetic Vertical Datum of 1929 (NGVD29), the elevations for the portions of the Zone AE streams listed below are still referenced to NGVD29 on the FIRMs and in the FIS Report. Due to the fact that base flood elevations along the listed flooding sources are depicted in NGVD 29 on panels 0060E, 0070E, 0078E, 0087E, 0089E, 0090E, 0150E, and 0155E, differences in base flood elevations may result across panel edges.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. Some of the data used in this revision were taken from the prior effective FIS reports and FIRMs and adjusted to NAVD88. The datum conversion factor from NGVD29 to NAVD88 in Indian River County is negative 1.4 feet.

For information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section.

Unless identified below, for all detailed flooding sources in Indian River County, the flood boundaries were interpolated between cross sections using 2007 Light Detection and Ranging (LiDAR) information (Reference 40). Blue Cypress Creek's flood boundaries were interpolated using topographic maps at scales of 1:24,000 with contour intervals of 5 feet, (Reference 24). Between transects, the boundaries were delineated using 2007 LiDAR information (Reference 40) and bathymetric maps (Reference 31).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM.

Some areas of the community that are protected from the 1-percent-annual-chance flood by a levee have been delineated as having potential risk due to possible failure or overtopping of the levee during larger floods.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (see

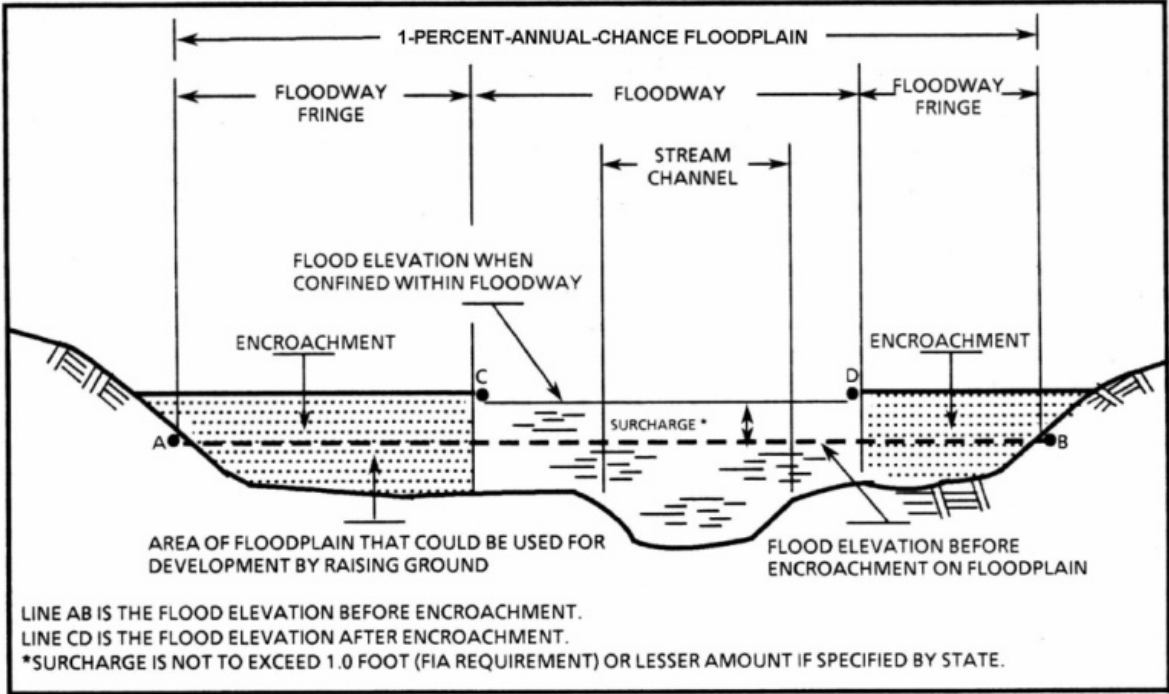
Table 9, “Floodway Data Table”). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Portions of the floodway for South Prong Creek lie outside the county boundary.

A floodway was not computed for Lateral H, Lateral J, Main Relief Channel, North Relief Channel, South Relief Channel, St. John’s Marsh, Vero Lakes Channel A, Vero Lakes Channel B, Vero Lakes Channel C, and Vero Lakes Channel D.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation (WSEL) of the base flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 3.

Figure 3: Floodway Schematic



FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD88)	WITHOUT FLOODWAY (NAVD88)	WITH FLOODWAY (NAVD88)	INCREASE
COLLIER CREEK								
A	656	110	381	2.8	4.8	4.8	5.7	0.9
B	1,037	64	299	3.5	6.1	6.1	7.1	1.0
C	1,822	28	200	5.3	8.6	8.6	9.1	0.5
D	2,223	23	188	5.2	10.7	10.7	10.8	0.1
E	3,069	14	123	7.9	12.3	12.3	12.8	0.5
F	3,737	52	260	3.8	14.2	14.2	14.7	0.5
G	4,465	150	667	0.8	17.8	17.8	17.8	0.0
H	4,835	115	609	0.9	17.8	17.8	17.8	0.0
I	5,428	90	490	1.1	17.9	17.9	17.9	0.0
J	6,072	94	515	1.1	18.0	18.0	18.0	0.0
K	6,624	97	557	1.0	18.0	18.0	18.0	0.0
L	7,088	99	484	1.1	18.0	18.0	18.0	0.0
M	7,987	80	414	1.3	18.1	18.1	18.1	0.0
N	8,566	83	430	1.3	18.2	18.2	18.2	0.0
O	9,126	90	475	1.2	18.6	18.6	18.6	0.0
P	9,588	93	414	1.3	18.6	18.6	18.6	0.0
Q	10,217	130	551	1.0	18.7	18.7	18.7	0.0

¹Feet above confluence with South Prong Creek

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

FLOODWAY DATA

COLLIER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD88)	WITHOUT FLOODWAY (NAVD88)	WITH FLOODWAY (NAVD88)	INCREASE
COLLIER WATERWAY								
A	100	83	488	1.1	17.0	17.0	18.0	1.0
B	1,500	83	658	0.9	17.2	17.2	18.2	1.0
C	1,904	86	587	1.0	17.2	17.2	18.2	1.0
D	2,384	80	483	1.0	17.2	17.2	18.2	1.0
E	3,293	95	813	0.5	17.2	17.2	18.2	1.0
F	4,253	99	626	0.6	17.3	17.3	18.3	1.0
G	4,973	102	673	0.6	17.3	17.3	18.3	1.0
H	5,613	112	947	0.4	17.3	17.3	18.3	1.0
I	5,914	94	773	0.5	17.3	17.3	18.3	1.0
J	6,374	117	935	0.4	17.3	17.3	18.3	1.0
K	7,894	88	574	0.7	17.3	17.3	18.3	1.0
L	8,854	90	458	0.5	17.4	17.4	18.4	1.0
M	10,019	77	536	0.4	17.5	17.5	18.4	0.9
N	10,289	74	558	0.4	17.5	17.5	18.4	0.9
O	12,239	76 ²	585	0.4	17.5	17.5	18.4	0.9
P	13,239	134	888	0.3	17.6	17.6	18.5	0.9

¹Feet above confluence with Elkcam Waterway

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

FLOODWAY DATA

COLLIER WATERWAY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD88)	WITHOUT FLOODWAY (NAVD88)	WITH FLOODWAY (NAVD88)	INCREASE
ELKCAM WATERWAY								
A	1,455	120	1,377	0.4	16.9	16.9	17.9	1.0
B	2,235	134	1,203	0.5	16.9	16.9	17.9	1.0
C	3,088	118	1,066	0.5	16.9	16.9	17.9	1.0
D	4,844	127	956	0.6	16.9	16.9	17.9	1.0
E	6,116	115	941	0.6	17.0	17.0	18.0	1.0
F	6,712	109	793	0.7	17.0	17.0	18.0	1.0
G	8,262	119	846	0.7	17.0	17.0	18.0	1.0

¹Feet above confluence with South Prong Creek

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

FLOODWAY DATA

ELKCAM WATERWAY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD88)	WITHOUT FLOODWAY (NAVD88)	WITH FLOODWAY (NAVD88)	INCREASE
SCHUMANN WATERWAY								
A	159	193	531	1.1	14.7	14.7	14.7	0.0
B	1,000	146	1,394	0.4	21.7	21.7	22.7	1.0
C	1,726	125	1,279	0.5	21.8	21.8	22.7	0.9
D	2,518	125	1,170	0.5	21.8	21.8	22.7	0.9
E	3,489	140	1,135	0.4	21.8	21.8	22.7	0.9
F	4,259	127	1,142	0.4	21.8	21.8	22.8	1.0
G	5,744	93	844	0.6	21.8	21.8	22.8	1.0
H	6,763	241	1,721	0.2	22.7	22.7	22.9	0.2
I	7,534	711	2,382	0.1	22.7	22.7	22.9	0.2
J	9,000	769	2,471	0.1	22.7	22.7	22.9	0.2
K	10,084	122	786	0.2	22.7	22.7	22.9	0.2

¹Feet above confluence with Collier Waterway

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

FLOODWAY DATA

SCHUMANN WATERWAY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD88)	WITHOUT FLOODWAY (NAVD88)	WITH FLOODWAY (NAVD88)	INCREASE
SEBASTIAN CREEK								
A	180	1,015 ²	8,063	0.7	4.4	2.5 ³	3.5	1.0
B	6,450	1,560 ²	11,996	0.5	4.4	2.8 ³	3.8	1.0

¹Feet above mouth

²Width extends beyond county boundary

³Elevations computed without consideration of backwater effects from Indian River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

FLOODWAY DATA

SEBASTIAN CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD88)	WITHOUT FLOODWAY (NAVD88)	WITH FLOODWAY (NAVD88)	INCREASE
SOUTH PRONG CREEK								
C	9,440	453 ²	3,035	2.0	4.4	2.9 ³	3.8	0.9
D	10,840	1,617 ²	11,233	0.4	4.4	3.0 ³	3.9	0.9
E	14,340	864	6,591	0.6	4.4	3.1 ³	4.0	0.9
F	17,740	800	3,960	1.0	4.4	3.2 ³	4.0	0.8
G	23,940	699	2,509	1.5	4.4	4.0 ³	4.6	0.6
H	29,440	600	2,824	1.3	5.0	5.0	5.4	0.4
I	44,175	265	1,518	2.1	9.0/10.4 ⁴	9.0/10.4 ⁴	9.4/10.8 ⁴	0.4
J	47,725	356	2,625	0.6	9.6/11.0 ⁴	9.6/11.0 ⁴	10.2/11.6 ⁴	0.6
K	50,875	53	329	4.6	9.8	9.8	10.4	0.6
L	53,375	135	614	2.4	12.9	12.9	13.9	1.0
M	55,375	42	262	5.7	15.9	15.9	16.7	0.8

¹Feet above mouth

²Width extends beyond county boundary

³Elevations computed without consideration of backwater effects from Indian River

⁴Elevations referenced to NAVD88/NGVD29. For a detailed explanation see the Notice to Flood Insurance Study Users

TABLE 9	FEDERAL EMERGENCY MANAGEMENT AGENCY INDIAN RIVER COUNTY, FL AND INCORPORATED AREAS	FLOODWAY DATA
		SOUTH PRONG CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD88)	WITHOUT FLOODWAY (NAVD88)	WITH FLOODWAY (NAVD88)	INCREASE
STREAM 1								
A	402	56	148	1.9	21.8	21.8	22.1	0.3
B	1,949	138	413	0.1	22.2	22.2	23.2	1.0
C	2,950	192	473	0.1	22.2	22.2	23.2	1.0

¹Feet above 18th Plaza Southwest

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

FLOODWAY DATA

STREAM 1

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent-annual-chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The countywide FIRM presents flooding information for the entire geographic area of Indian River County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 10, "Community Map History."

7.0 OTHER STUDIES

FIS reports were previously prepared for the unincorporated areas of Indian River County (Reference 41) and for the Cities of Sebastian and Vero Beach, and the Towns of Indian River Shores and Orchid (References 42; 43; 44; 45).

FIS reports were previously prepared for the unincorporated and incorporated areas of Osceola County (Reference 46) and St. Lucie County (Reference 47), for the unincorporated areas of Okeechobee County (Reference 48), and for Brevard County, Florida and incorporated areas (Reference 49).

This FIS report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting Federal Insurance and Mitigation Division, FEMA Region IV, Koger-Center — Rutgers Building, 3003 Chamblee Tucker Road, Atlanta, GA 30341.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Fellsmere, City of	May 4, 1989	---	May 4, 1989	---
Indian River County, Unincorporated Areas	December 20, 1974	---	July 3, 1978	January 23, 1981 December 1, 1982 October 1, 1983
Indian River Shores, Town of	October 26, 1973	April 23, 1976	September 5, 1979	September 30, 1982
Orchid, Town of	January 23, 1974	February 13, 1976	April 15, 1980	---
Sebastian, City of	February 8, 1974	July 11, 1975	April 15, 1980	---
Vero Beach, City of	December 6, 1974	---	September 30, 1977	December 15, 1982

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

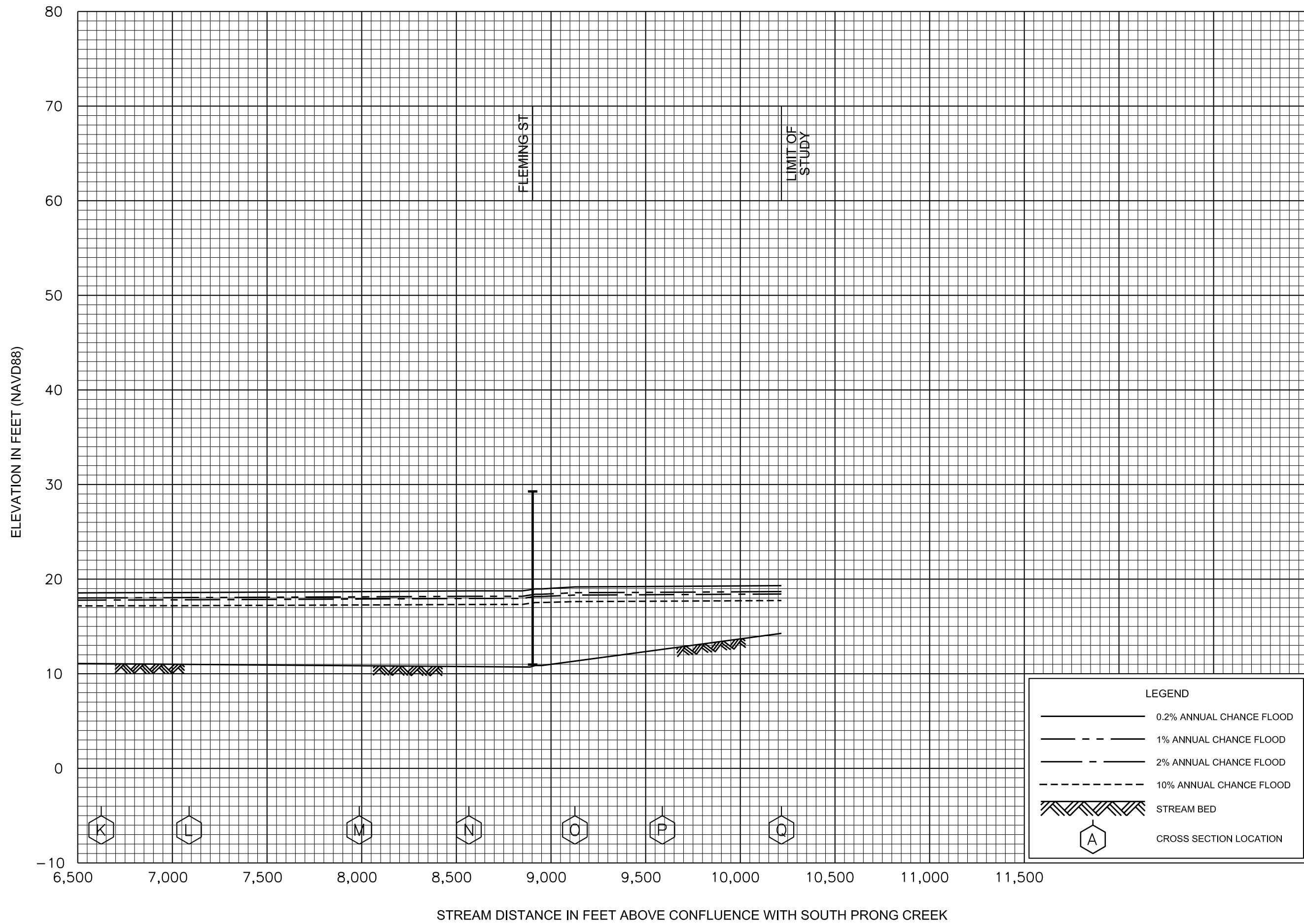
9.0 **BIBLIOGRAPHY AND REFERENCES**

1. Federal Emergency Management Agency. *Flood Insurance Study, Indian River County, Florida, and Incorporated Areas*. Washington, D.C., May 4, 1989.
2. Southeast Regional Climate Center. Historical Climate Summaries for Florida: City of Vero Beach. [Online] [Cited: January 29, 2009.] http://www.sercc.com/climateinfo/historical/historical_fl.html.
3. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. *Environmental Data Services: Climatological Data for Florida*. Asheville, North Carolina, 1985.
4. U.S. Department of Commerce, Bureau of the Census. "State & County Quickfacts, Florida Quicklinks". [Online] [Cited: January 21, 2009.] <http://www.census.gov/census2000/states/fl.html>.
5. U.S. Department of Commerce, Bureau of the Census. *American FactFinder*. [Online] [Cited: December 15, 2009.] <http://factfinder.census.gov>.
6. American Meteorological Society. *Early American Hurricanes 1492-1870*. David M. Ludlum, 1963.
7. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climate Data Center. "Storm Events". [Online] [Cited: January 21, 2009.] <http://www4.ncdc.noaa.gov>.
8. U.S. Department of the Army, Corps of Engineers, Jacksonville District. *Central and Southern Florida Project, Part III, Upper St. John's River Basin and Related Areas, Supplement 2: General Design Memorandum, Upper St. John's River Basin, Addendum 3 with Draft Environmental Impact Statement*. Jacksonville, Florida, June 1985.
9. U.S. Department of the Interior, Geological Survey, in cooperation with the Florida Department of Transportation. *Water Resources Investigations 82-4012: Technique for Estimating Magnitude and Frequency of Floods on Natural-Flow Streams in Florida*. , 1982.
10. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center. HEC-HMS Hydrologic Modeling System 3.30. Davis, CA : October 9, 2008.
11. U.S. Department of Agriculture, Natural Resources Conservation Service. *Technical Release 55 - Urban Hydrology for Small Watersheds*. June 1986.
12. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. Unit Hydrograph Technical Manual. *National Weather Service - National Operational Hydrologic Remote Sensing Center*. [Online] October 12, 2008. [Cited: June 1, 2009.] http://www.nohrsc.noaa.gov/technology/gis/uhg_manual.html.

13. U.S. Department of Commerce, Geological Survey, Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee. *Bulletin No. 17B: Guidelines for Determining Flood Flow Frequency*. Washington, D.C., September 1981, Revised March 1982.
14. Streamline Technologies, Inc. *ICPR 3.10 SP4*. 2002.
15. U.S. Department of Commerce, Environmental Science Services Administration. *Technical Memorandum WBTM, Hydro 11: Joint Probability Method of Tide Frequency Analysis Applied to Atlantic City and Long Beach Island, New Jersey*. Vance A. Myers, April 1970.
16. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service. *Tropical Cyclones of the North Atlantic Ocean, 1871-1984*. July 1985.
17. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. *Technical Report NWS 15: Some Climatological Characteristics of Hurricanes and Tropical Storms, Gulf and East Coasts of the United States*. Frances P. Ho, Richard W. Schwerdt, and Hugo V. Goodyear, May 1975.
18. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. *Technical Report NWS 23: Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Windfields, Gulf and East Coasts of the United States*. September 1979.
19. Federal Emergency Management Agency. *Coastal Flooding Storm Surge Model, Part I: Methodology, and Part II: Code and Users Guide*. Washington, D.C. : Tetra Tech, Inc., February 1981.
20. U.S. Department of the Army, Corps of Engineers, Coastal Engineering Research Center. *Shore Protection Manual*. Vicksburg, Mississippi, 1984.
21. Federal Emergency Management Agency, Federal Insurance Administration. *User's Manual for Wave Action Effects Associated with Storm Surges*. , April 1980.
22. Carter Associates, Inc. *Ground and Bathymetric Surveys: Vero Beach, Florida*. : Under contract to Gee & Jensen Engineers-Architects-Planner, 1986.
23. General Development Corporation. *Cross Section Surveys, Collier Creek, Elkcam Waterway/Collier Waterway*. , 1984-1986.
24. U.S. Department of the Interior, Geological Survey. *7.5 Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 5 Feet: Kenansville SE, FL, 1953, photorevised 1972; Fellsmere SW, FL, 1953, photorevised 1970; Fellsmere, FL, 1949, photorevised 1970; . s.l. : Fellsmere 4 SW, FL, 1953, photorevised 1970; Fellsmere SE, FL, 1953, photorevised 1970; Oslo, FL, 1949, photorevised 1970; Indrio, FL, 1948, photorevised 1970, Sebastian, FL, 1949, photorevised 1970; Fort Drum NE, FL, 1953, photorevised 1972; Fellsmere 4 NW, FL, 1953, photorevised 1970; Vero Beach, FL, 1949, photorevised, 1970; Riomar, FL, 1948, photorevised 1970; Fort Drum, FL, 1953, photorevised 1972;*
25. Southern Resources Mapping Corporation/Reynolds, Smith and Hills. *Atlas of the City of Vero Beach, Scale 1:2,400, Contour Interval 1 Foot*. Vero Beach, Florida, June 1980.

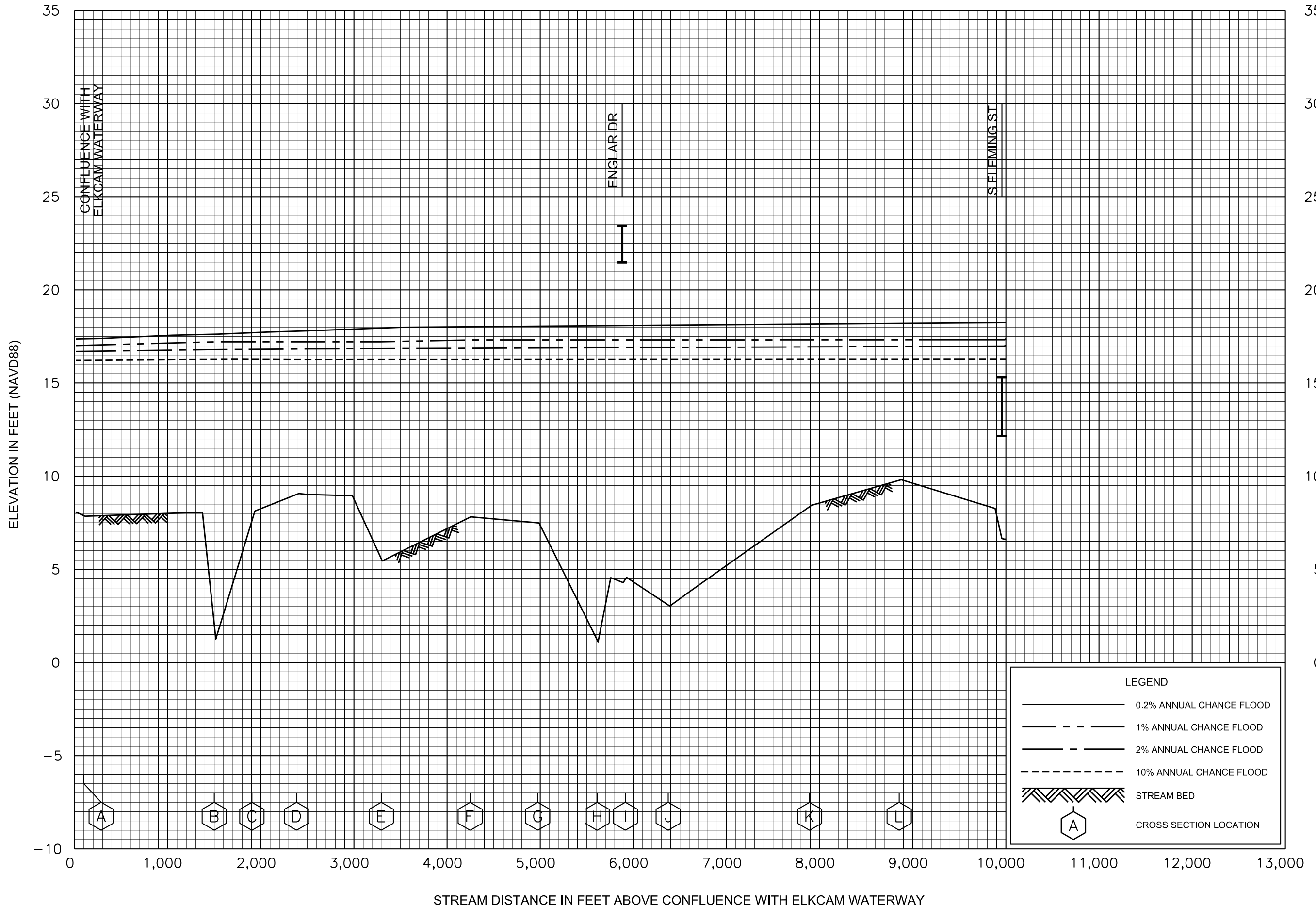
26. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center. *HEC-2 Water Surface Profiles, Generalized Computer Program 723-X6-L202A*. Davis, California, April 1984.
27. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center. *HEC-RAS 3.1.3*. Davis, CA : s.n., May 2005.
28. Chow, Ven Te. *Open Channel Hydraulics*. New York : McGraw-Hill, 1959.
29. U.S. Department of Agriculture, Soil Conservation Service. *Guide for Selecting Roughness Coefficient "n" Values for Channels*. , December 1963.
30. U.S. Department of Transportation, Federal Highway Administration. *Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains*. , April 1984.
31. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey. *Bathymetric Maps, Datum Mean Low Water, NG 17-2 and NG 17-11, Scale 1:25,000: Fort Pierce, Florida*. Orlando, Florida, 1972.
32. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey. *NOS Hydrographic Surveys, Scale 1:40,000: H1488A, 1881; H5034, 1930; H4946, 1929; H5039, 1930; H4344, 1973; H9358, 1973; Scale 1:20,000: H1411A, 1878; H1415B, 1878; H1416, 1878; H8343, 1956; H8341, 1956; Scale 1:10,000: H8340, 1956; H8343, 1956*.
33. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey. *Nautical Charts: No. 11460, February 1982; No. 11472, August 1976; No. 11474, March 1980; No. 11476, May 1982; No. 11480, November 1981; No. 11484, April 1983*.
34. Florida Department of Natural Resources, Division of Beaches and Shores. *Indian River County Beach Profiles*. , June 1986.
35. Florida Department of Transportation, Topographic Bureau. *Coastal Construction Control Line Aerials of Indian River County, Florida, Scale 1:2,400*. Tallahassee, Florida, May 1986.
36. National Academy of Sciences. *Methodology for Calculating Wave Action Effects with Storm Surges*. , 1977.
37. Federal Emergency Management Agency. *Guidelines and Specifications for Wave Elevation Determination*. Washington, D.C., in progress.
38. Abrams Aerial Surveys. *Indian River County Beach Preservation Plan, Scale 1:1,200 reduced to 1:6,000, Contour Interval 1 Foot*. , December 1985.
39. Federal Emergency Management Agency. *Manual for Wave Runup Analysis Coastal Flood Insurance Studies*. Stone and Webster Engineering Corporation, November 1981.
40. Woolpert, Inc. *Project Management and Technical Services for Mapping within Coastal Florida*. Tallahassee : Florida Department of Emergency Management, 2008.

41. Federal Emergency Management Agency. *Flood Insurance Study, Indian River County, Florida, Unincorporated Areas*. Washington, D.C., October 1983.
42. Federal Emergency Management Agency. *Flood Insurance Study, City of Sebastian, Indian River County, Florida*. Washington, D.C., April 1980.
43. Federal Emergency Management Agency. *Flood Insurance Study, City of Vero Beach, Indian River County, Florida*. Washington, D.C., December 1982` .
44. Federal Emergency Management Agency. *Flood Insurance Study, Town of Indian River Shores, Indian River County, Florida*. Washington, D.C., September 1982.
45. Federal Emergency Management Agency. *Flood Insurance Study, Town of Orchid, Indian River County, Florida*. Washington, D.C., April 1980.
46. Federal Emergency Management Agency. *Flood Insurance Study, Osceola County, Florida, and Incorporated Areas*. Washington, D.C., May 7, 2001.
47. Federal Emergency Management Agency. *Flood Insurance Study, St. Lucie County, Florida, and Incorporated Areas*. Washington, D.C., August 19, 1991.
48. Federal Emergency Management Agency. *Flood Insurance Study, Okeechobee County, Florida, Unincorporated Areas*. Washington, D.C., August 4, 1980.
49. Federal Emergency Management Agency. *Flood Insurance Study, Brevard County, Florida, and Incorporated Areas*. Washington, D.C., April 3, 1989.



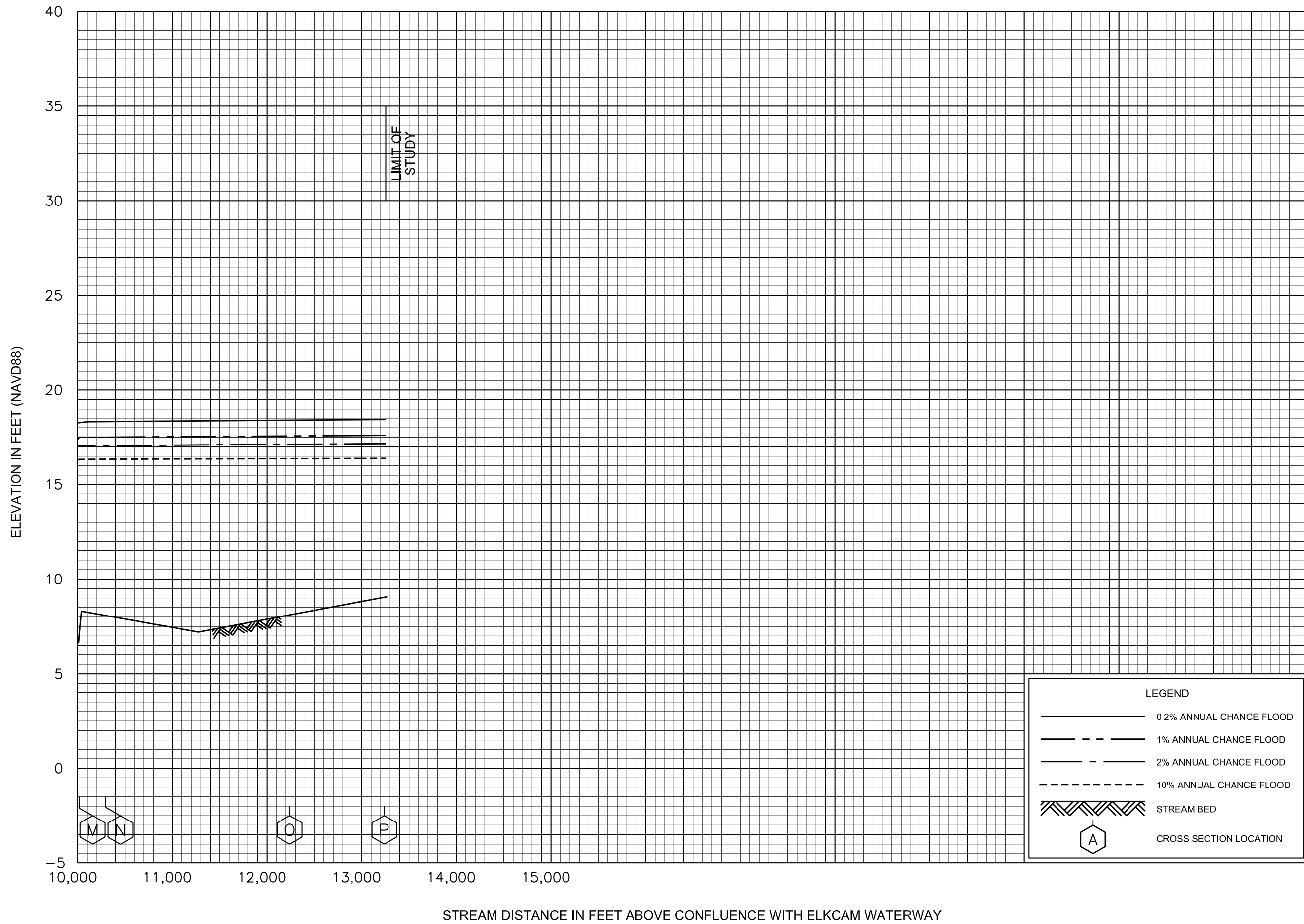
FLOOD PROFILES
COLLIER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS



FLOOD PROFILES
COLLIER WATERWAY

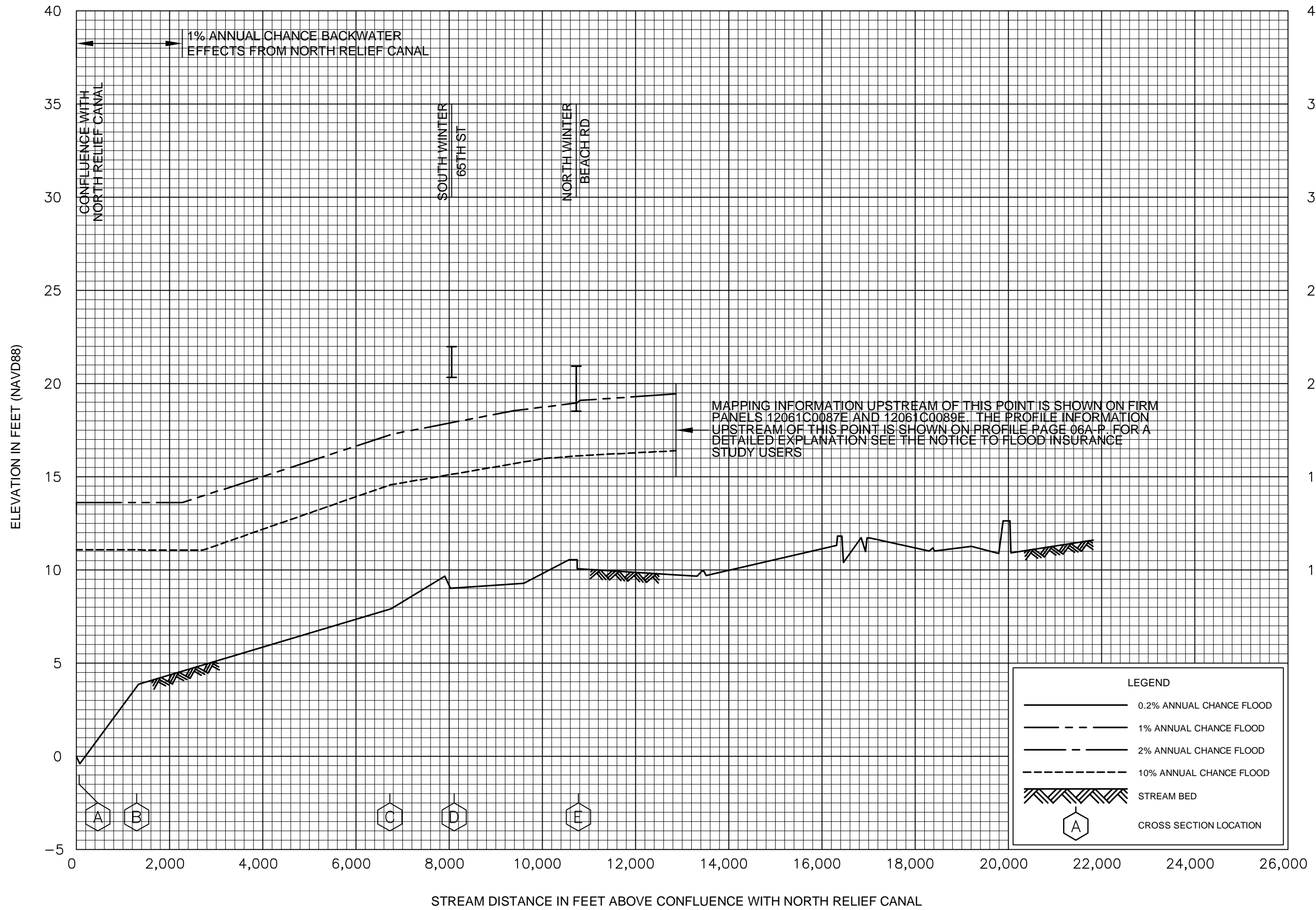
FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS



FLOOD PROFILES
COLLIER WATERWAY

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS

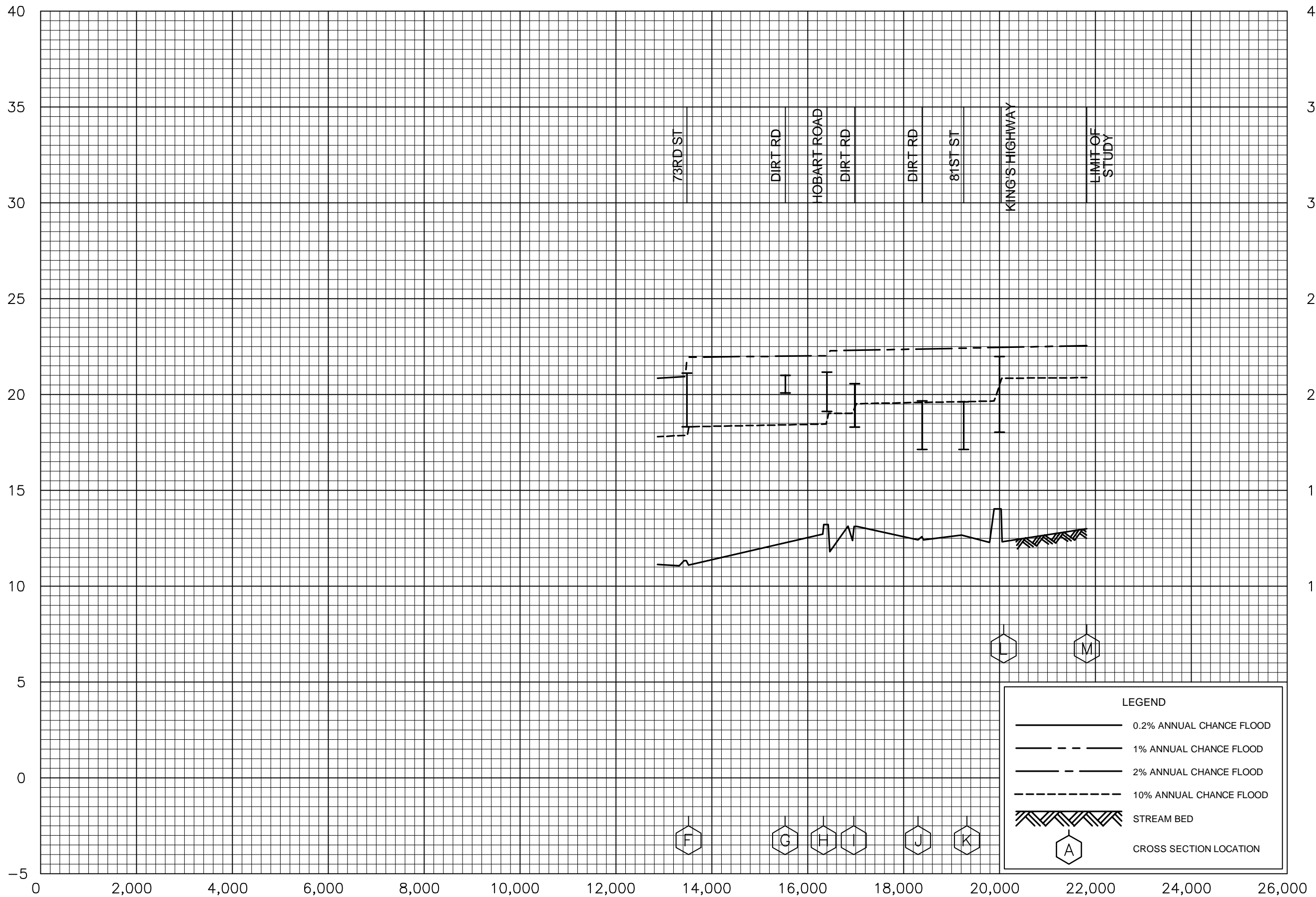
04P



FLOOD PROFILES
LATERAL G

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS

ELEVATION IN FEET (NGVD29)



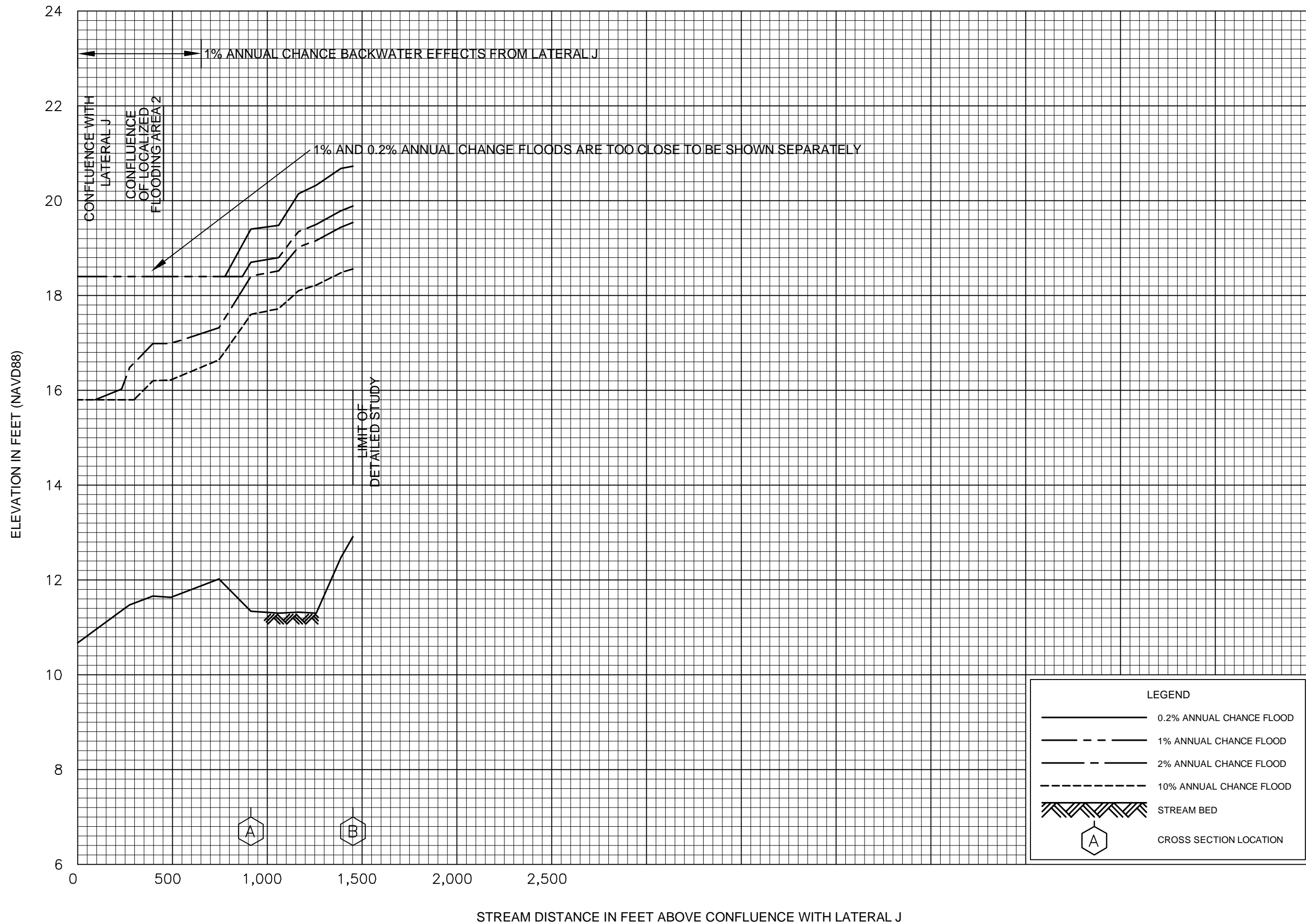
STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH NORTH RELIEF CANAL

FLOOD PROFILES

LATERAL G

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS

06-AP

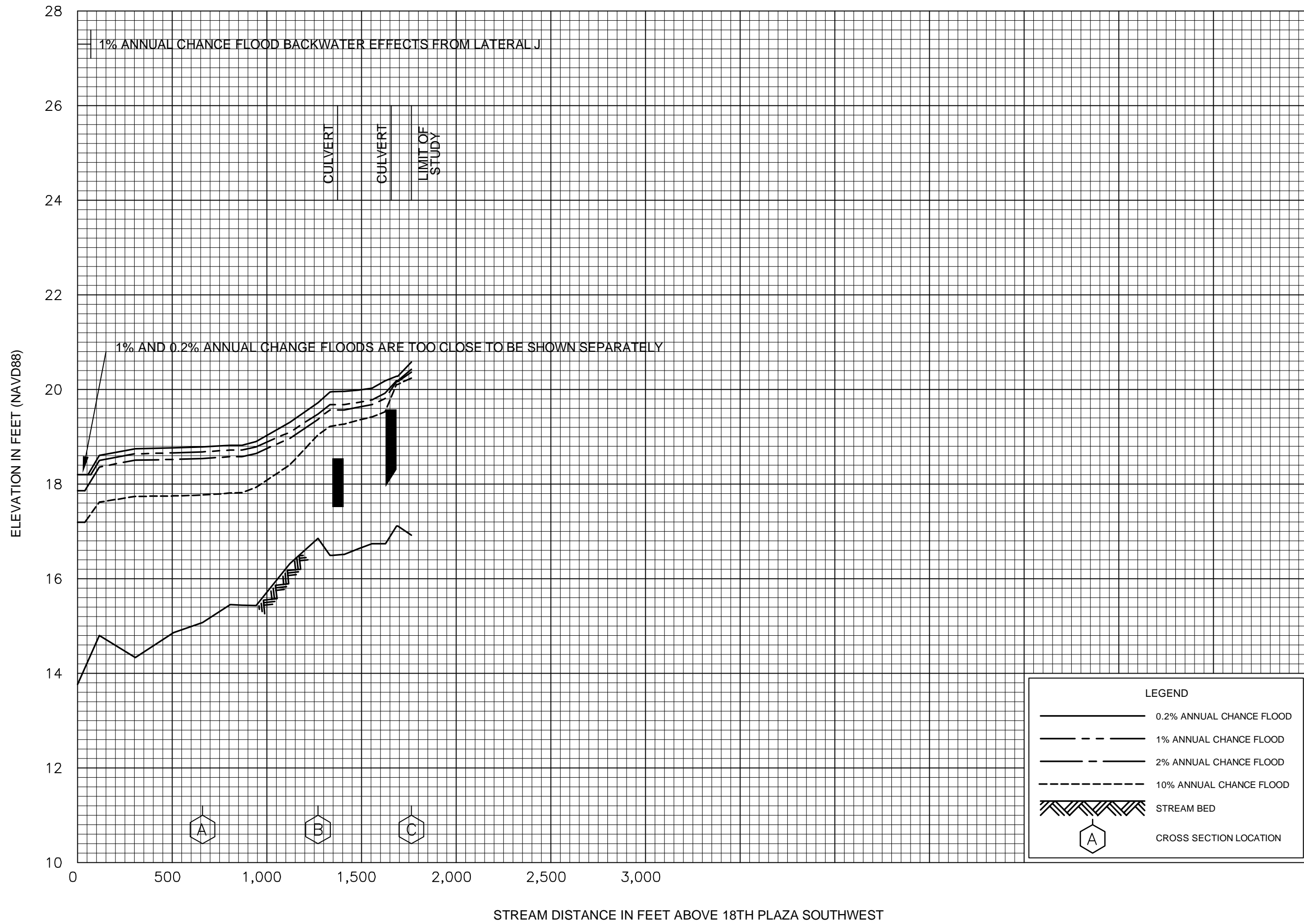


FLOOD PROFILES

LOCALIZED FLOODING AREA 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS

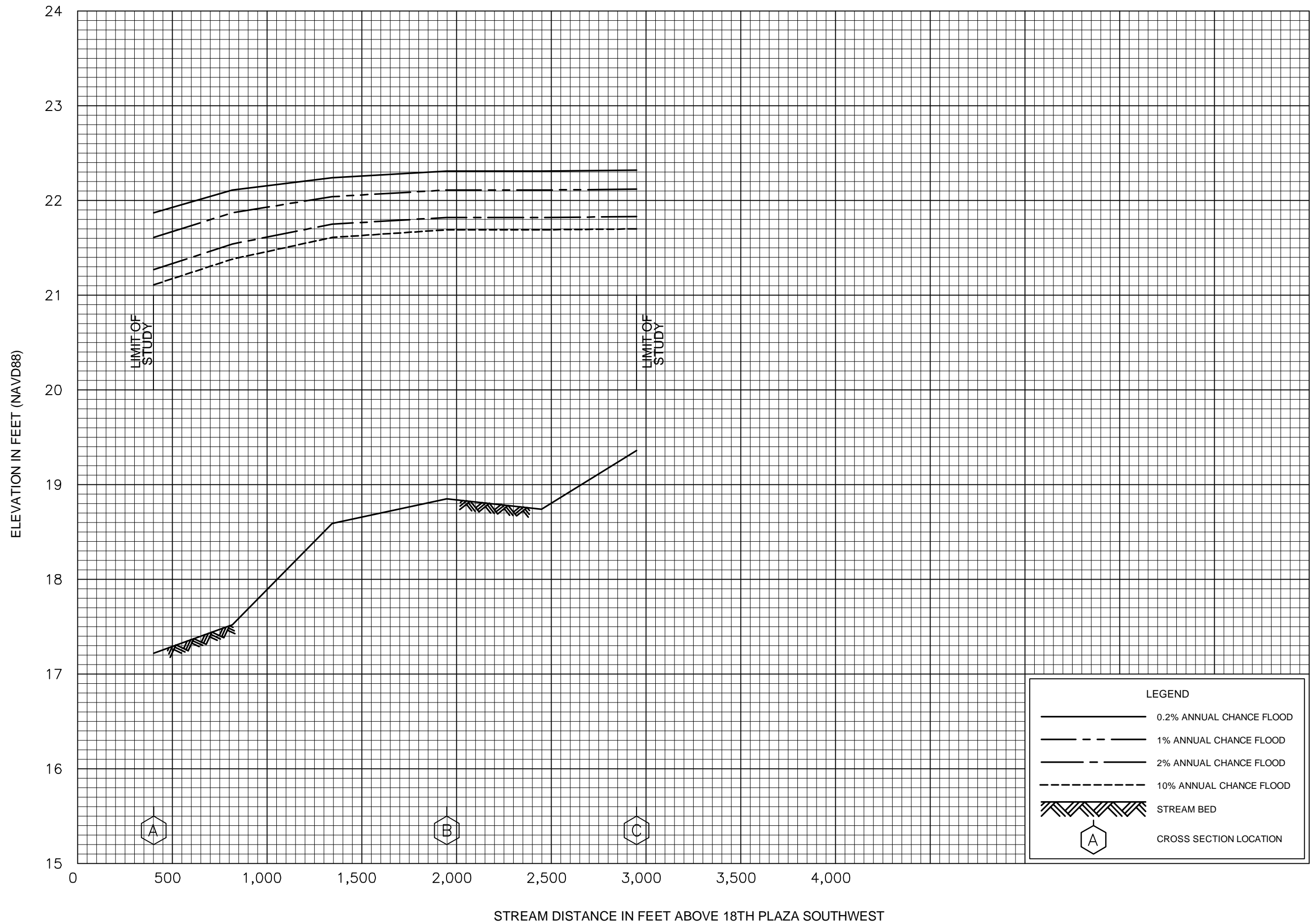
09P



FLOOD PROFILES

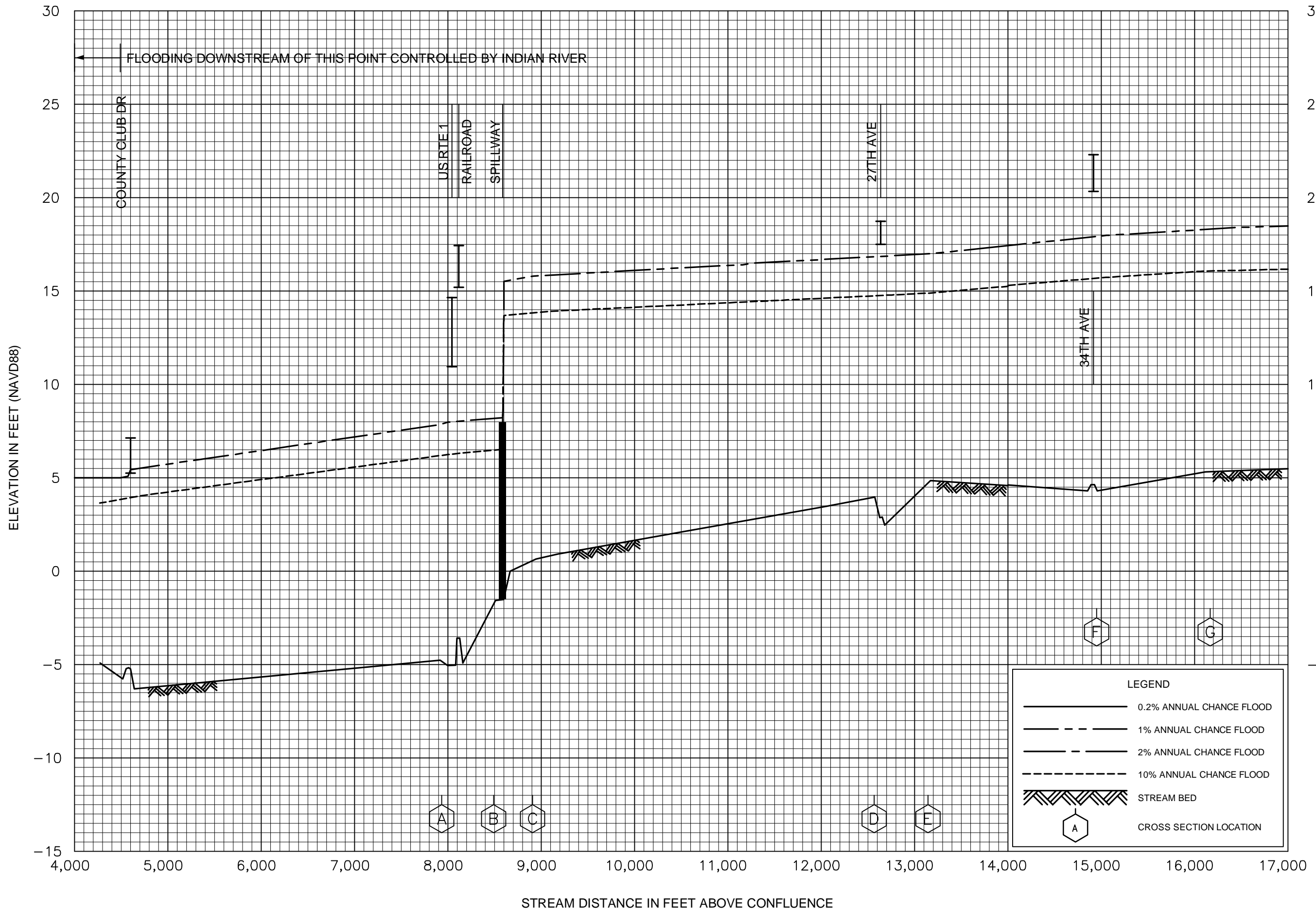
LOCALIZED FLOODING AREA 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS



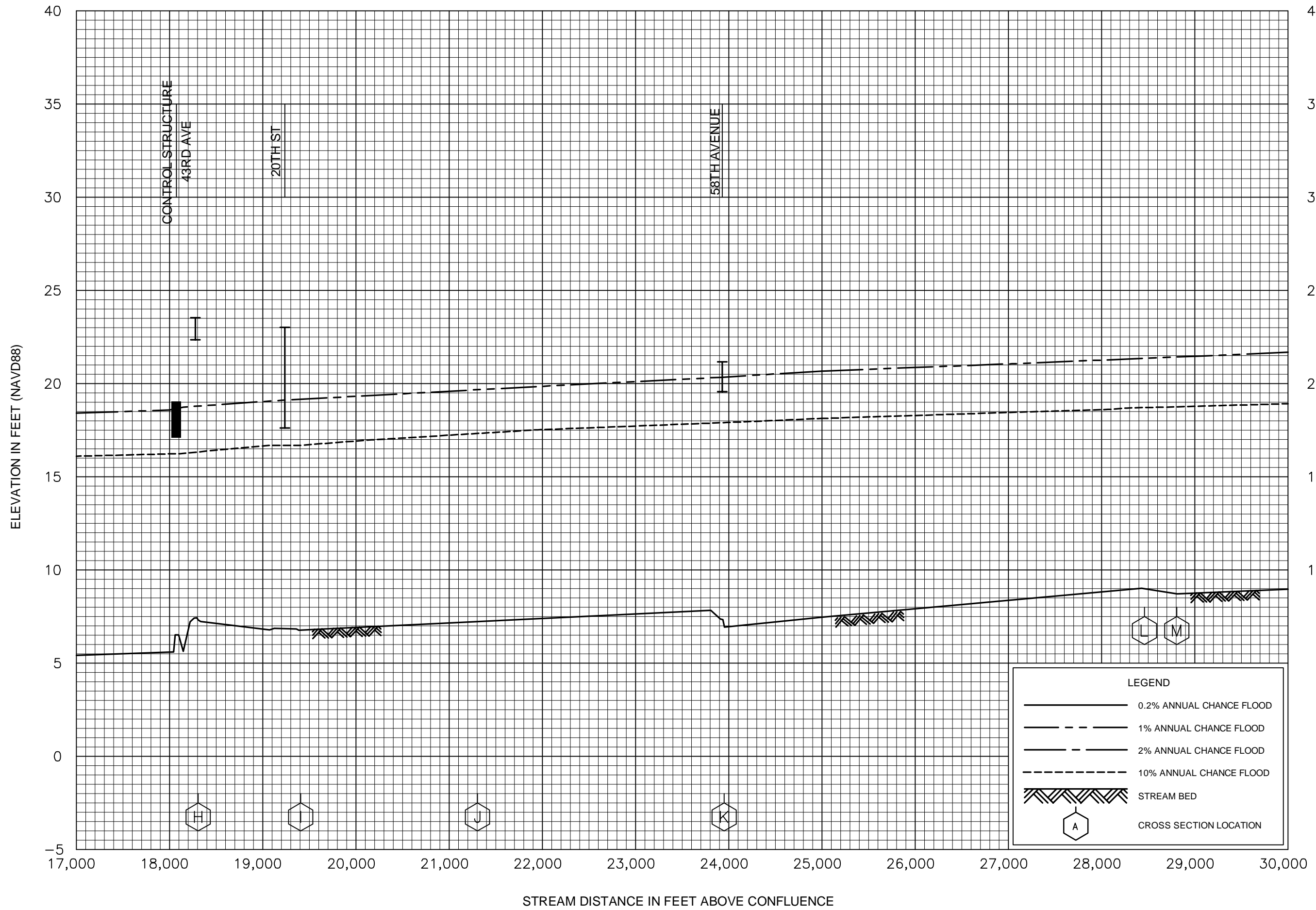
FLOOD PROFILES
 LOCALIZED FLOODING AREA 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
 INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS



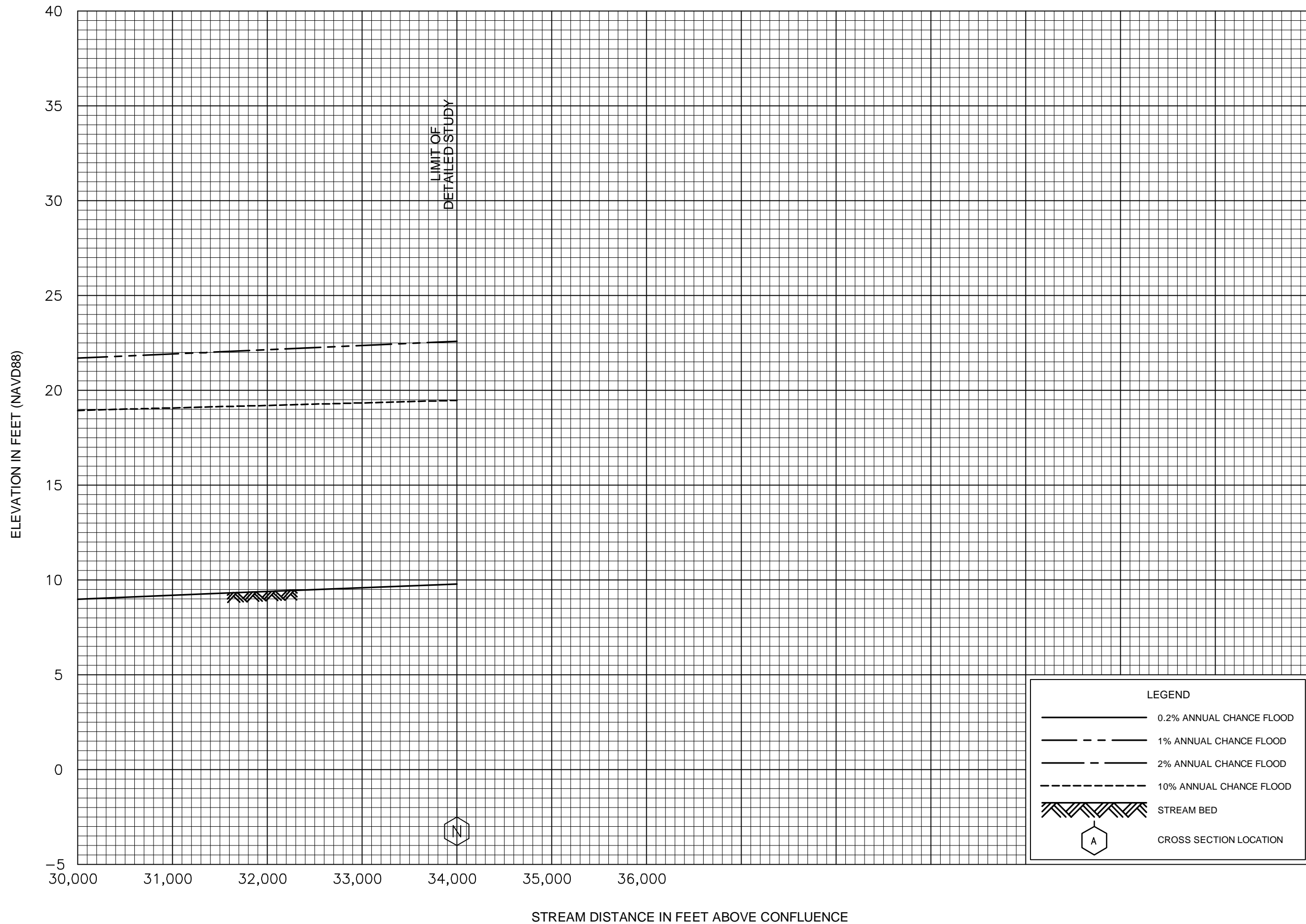
FLOOD PROFILES
MAIN RELIEF CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS



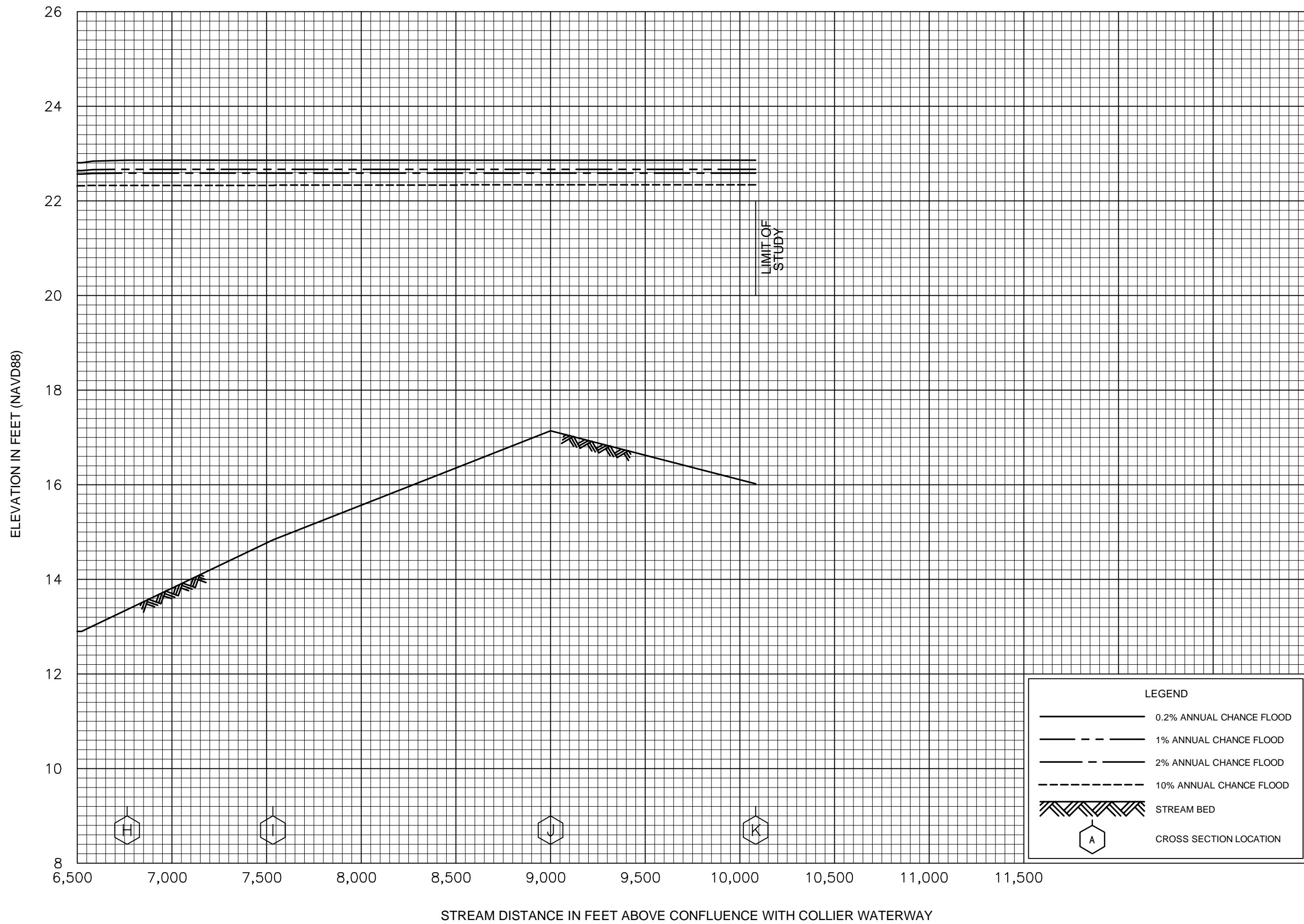
FLOOD PROFILES
MAIN RELIEF CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS



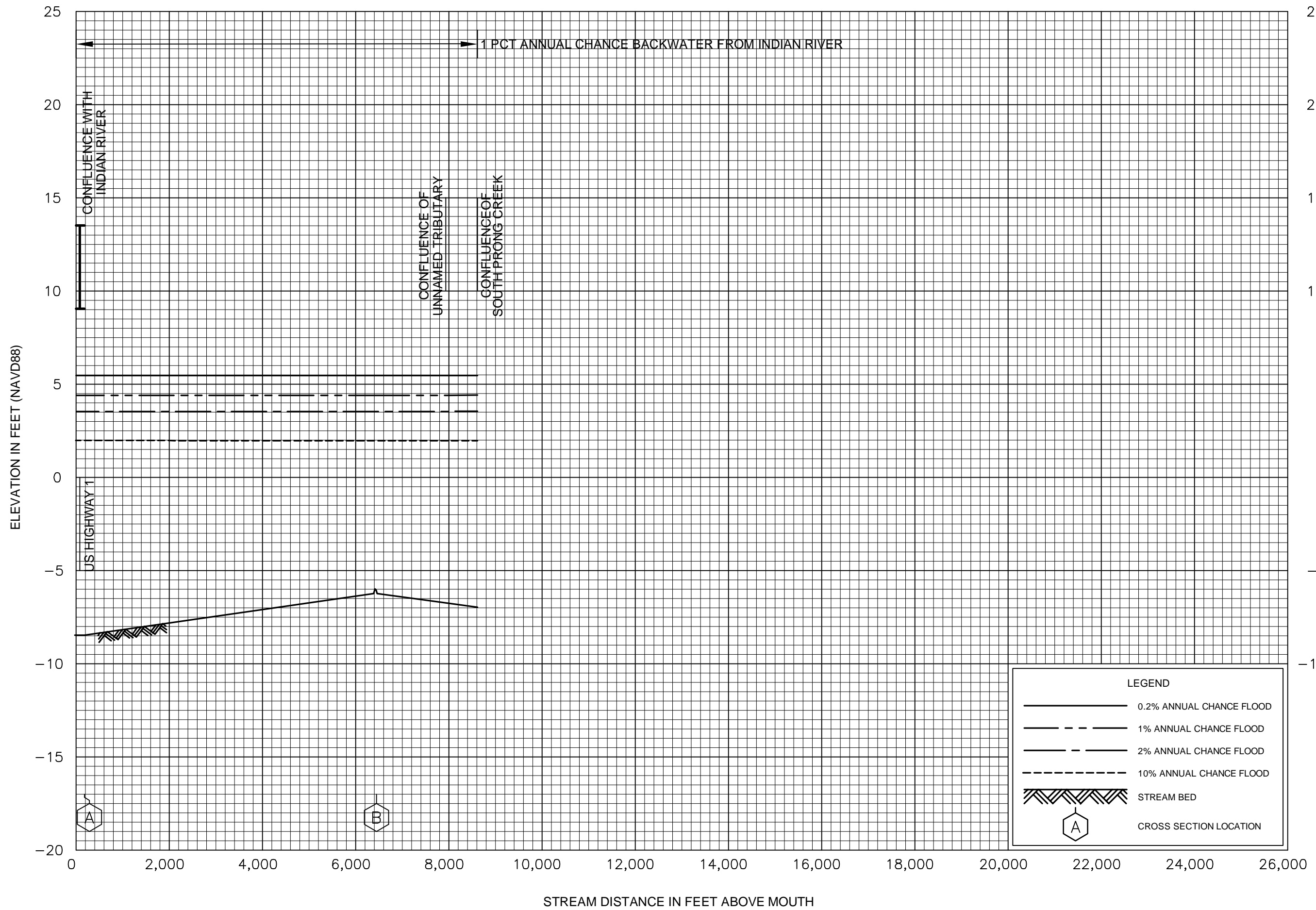
FLOOD PROFILES
 MAIN RELIEF CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY
 INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS



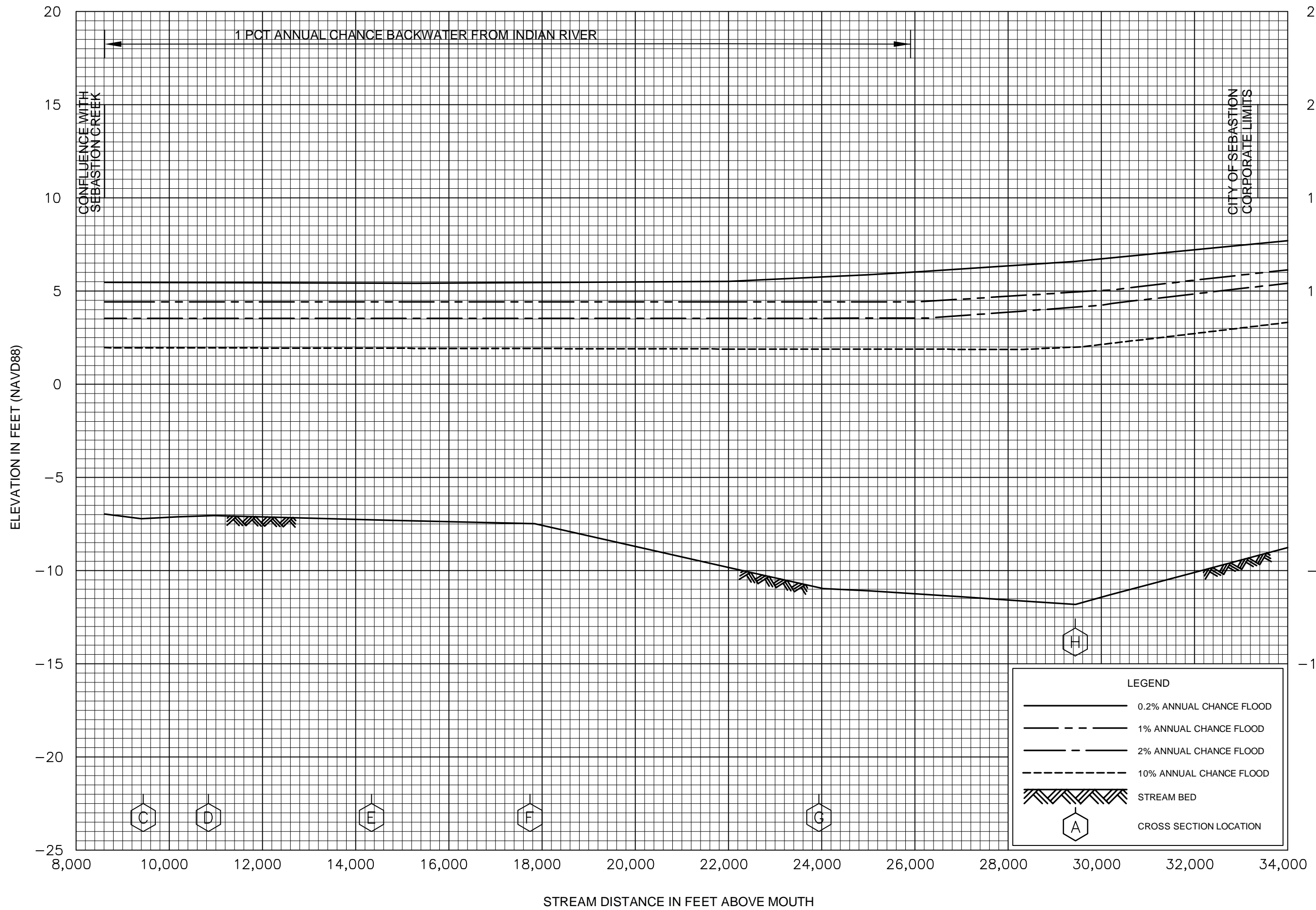
FLOOD PROFILES
SCHUMANN WATERWAY

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS



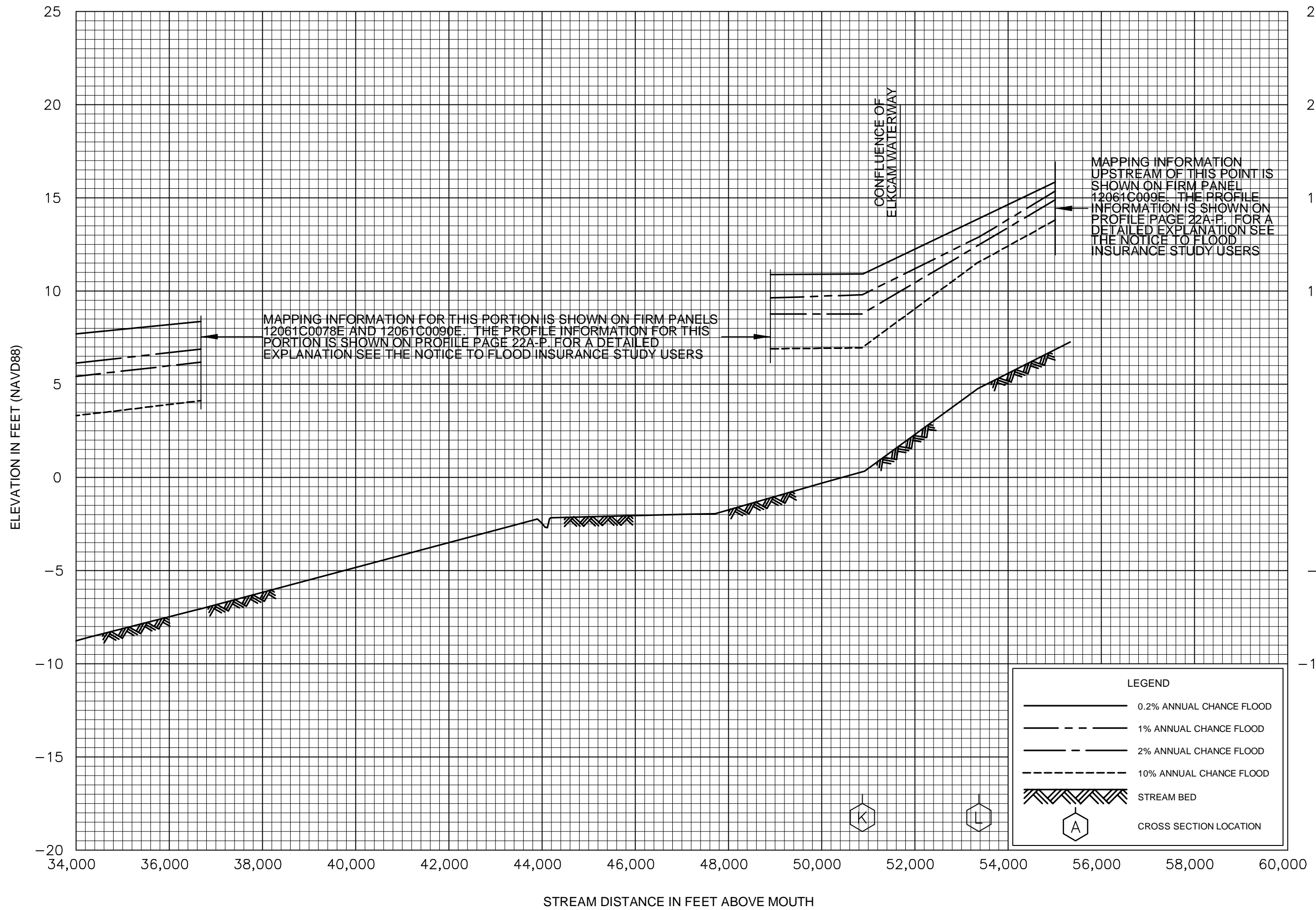
FLOOD PROFILES
SEBASTION CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS



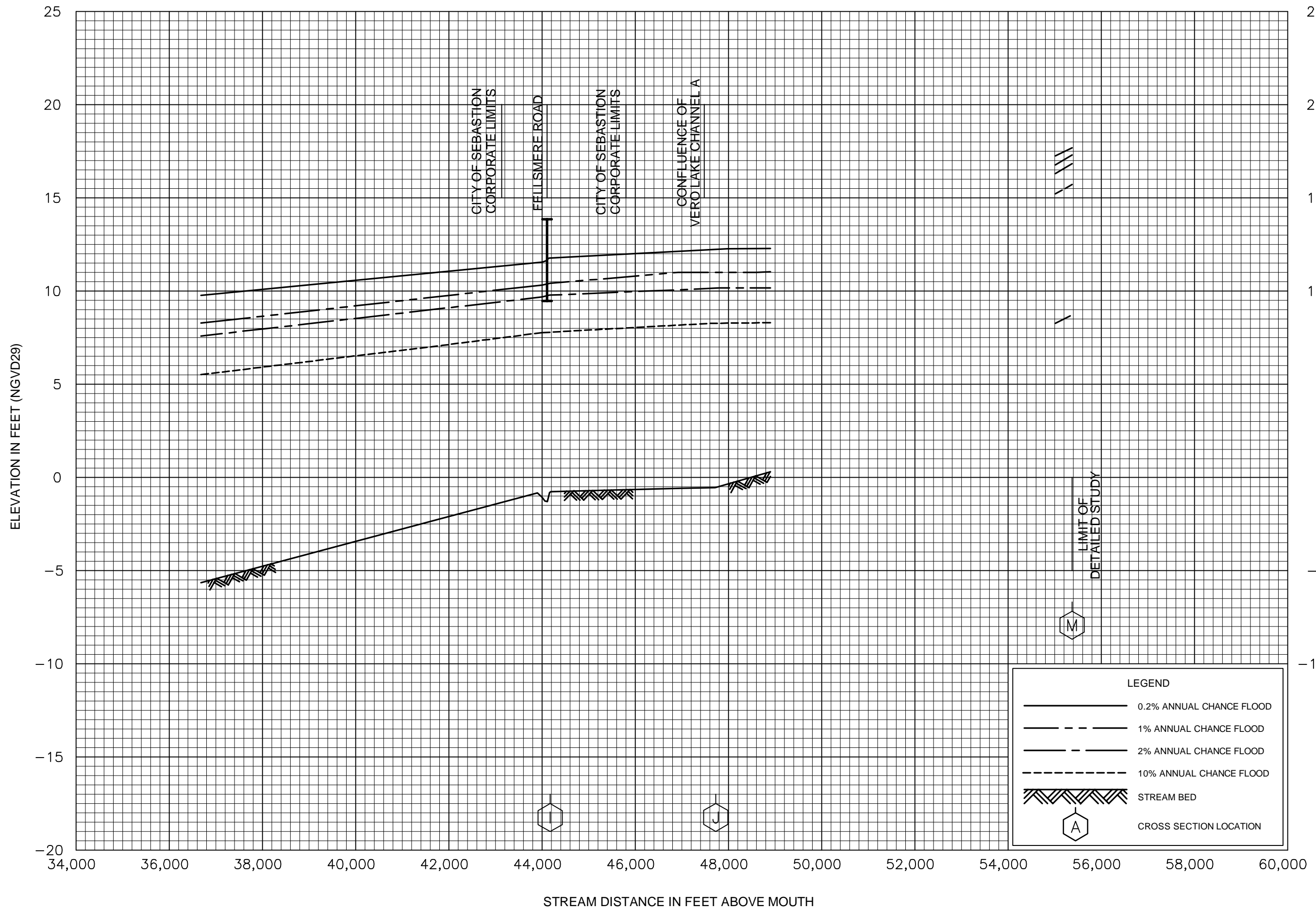
FLOOD PROFILES
SOUTH PRONG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS



FLOOD PROFILES
SOUTH PRONG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS









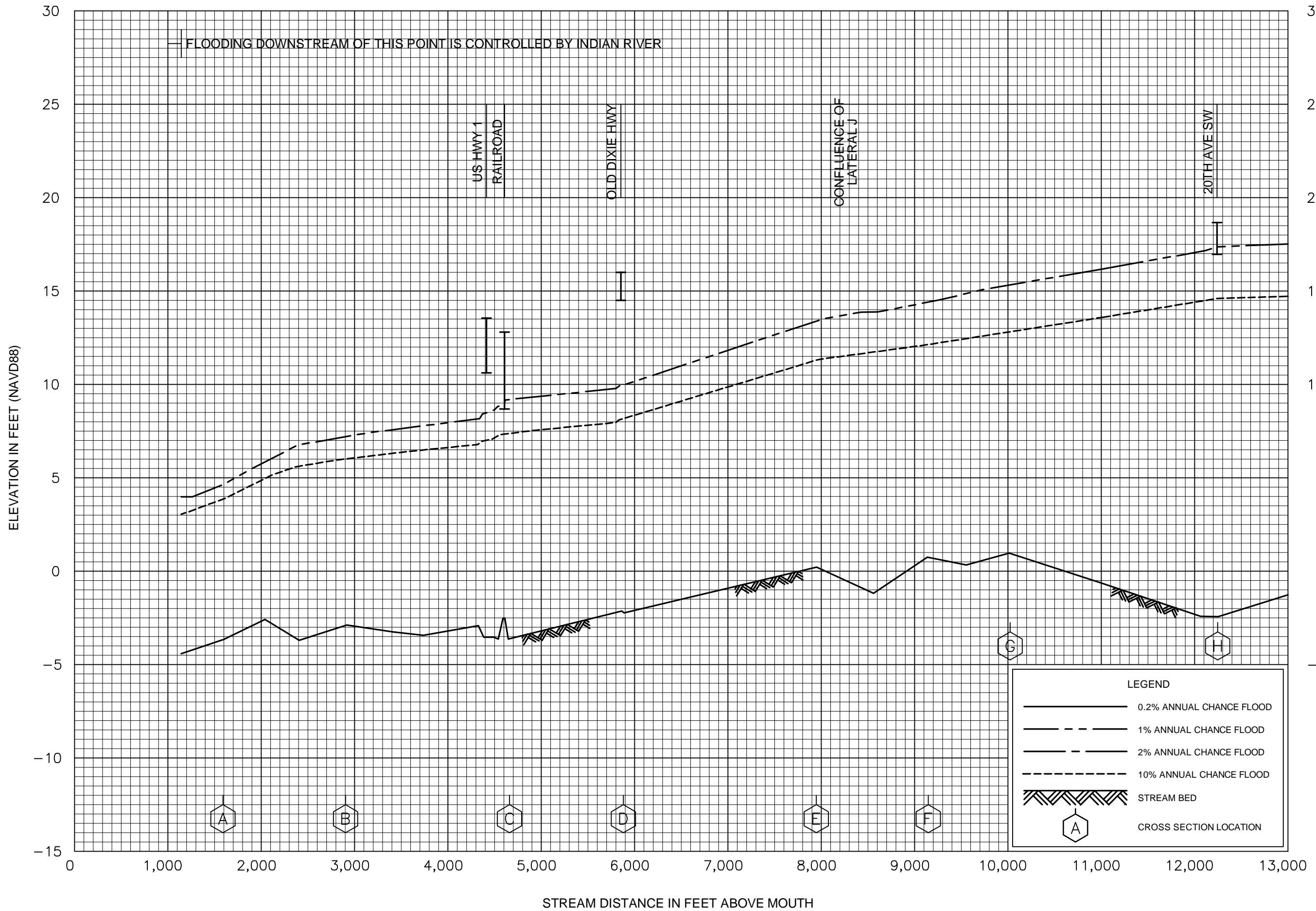
FLOOD PROFILES

SOUTH PRONG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

LEGEND

-  0.2% ANNUAL CHANCE FLOOD
-  1% ANNUAL CHANCE FLOOD
-  2% ANNUAL CHANCE FLOOD
-  10% ANNUAL CHANCE FLOOD
-  STREAM BED
-  CROSS SECTION LOCATION



FLOODING DOWNSTREAM OF THIS POINT IS CONTROLLED BY INDIAN RIVER

US HWY 1
RAILROAD

OLD DIXIE HWY

CONFLUENCE OF
LATERAL J

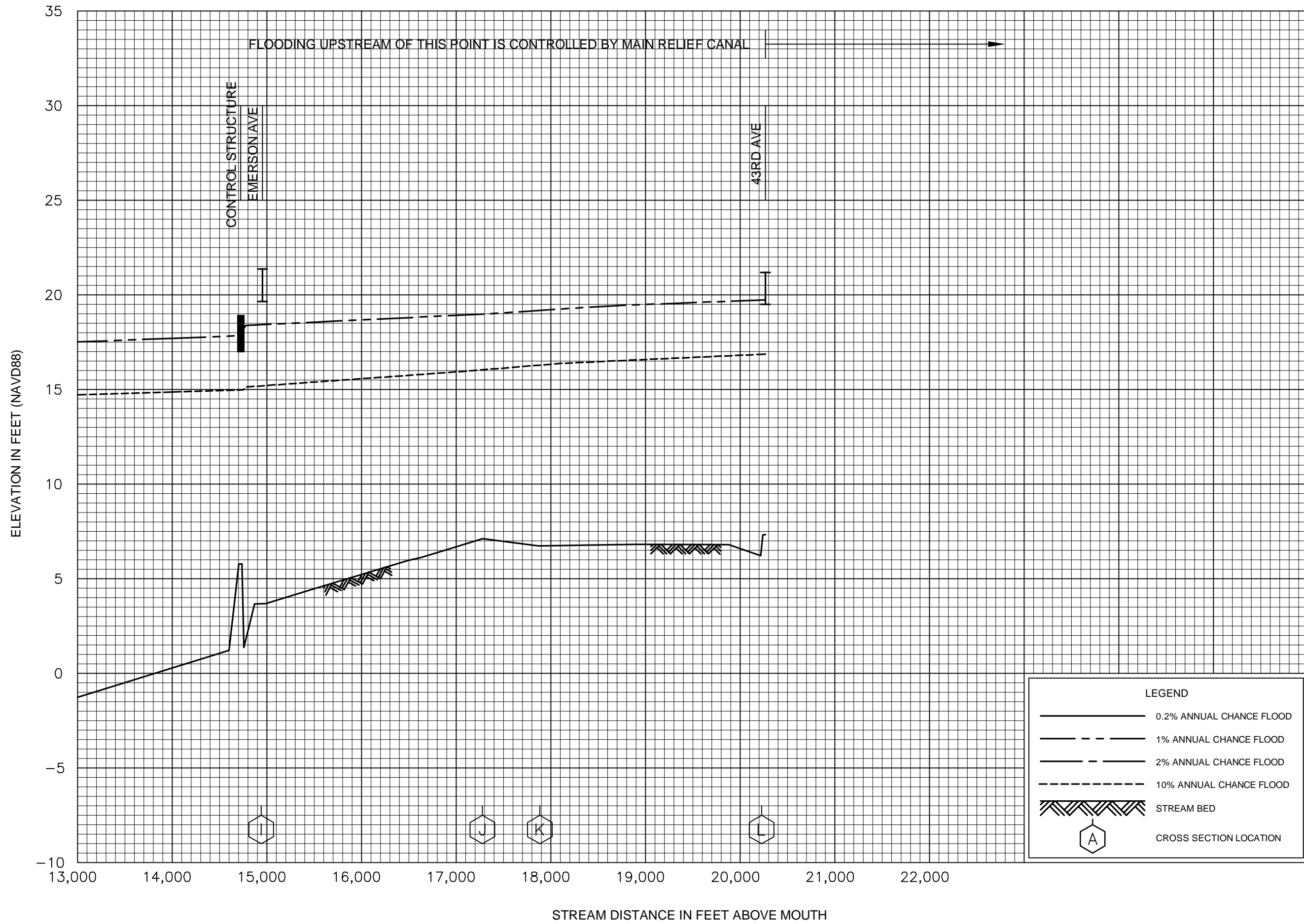
20TH AVE SW

FLOOD PROFILES

SOUTH RELIEF CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS

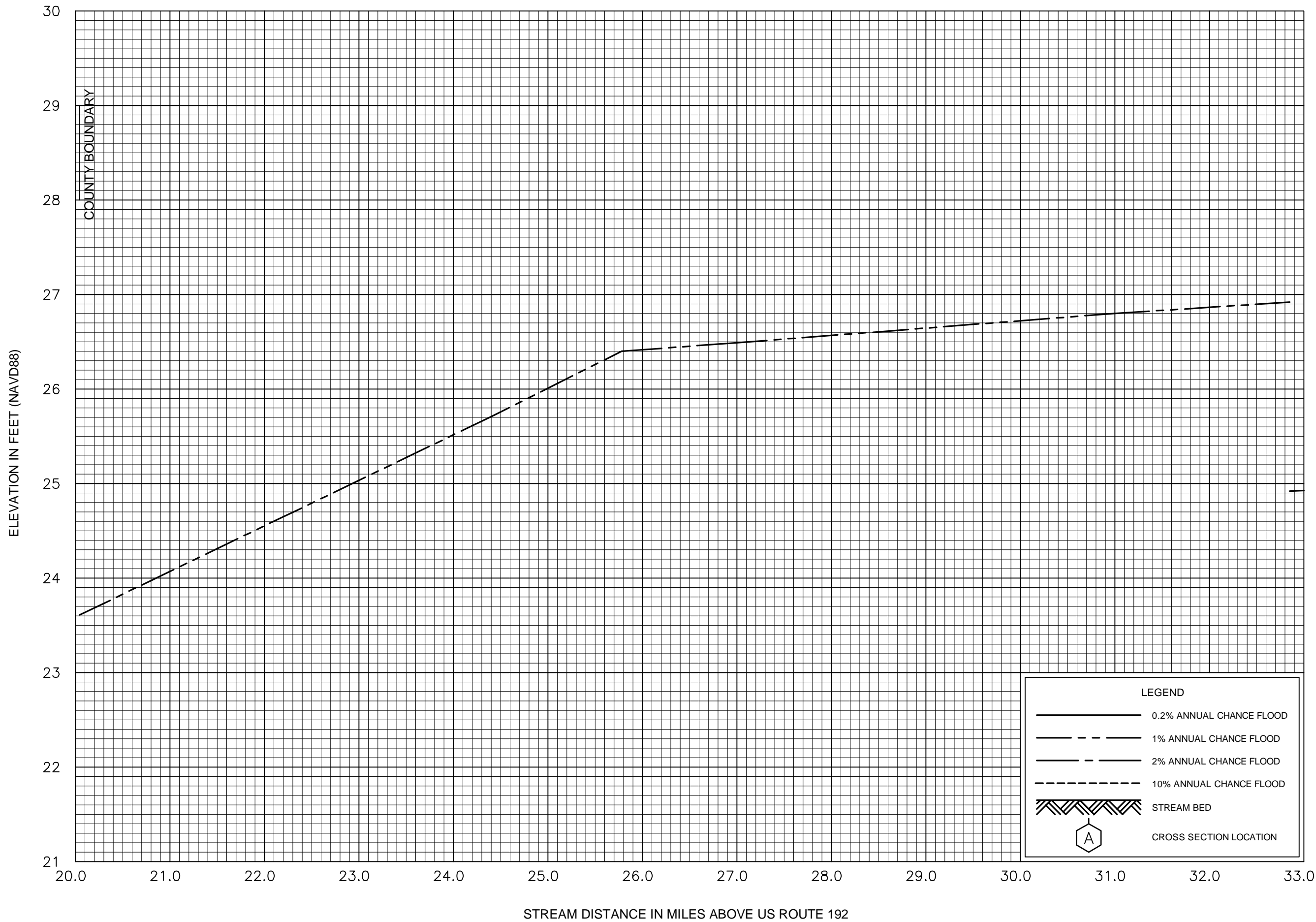


FLOOD PROFILES

SOUTH RELIEF CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS



FLOOD PROFILES
ST. JOHN'S MARSH

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS

ELEVATION IN FEET (NAVD88)

33
32
31
30
29
28
27
26
25
24

33
32
31
30
29
28
27
26

33.0 34.0 35.0 36.0 37.0 38.0 39.0

STREAM DISTANCE IN MILES ABOVE US ROUTE 192

STATE RD 60
LIMIT OF
DETAILED STUDY

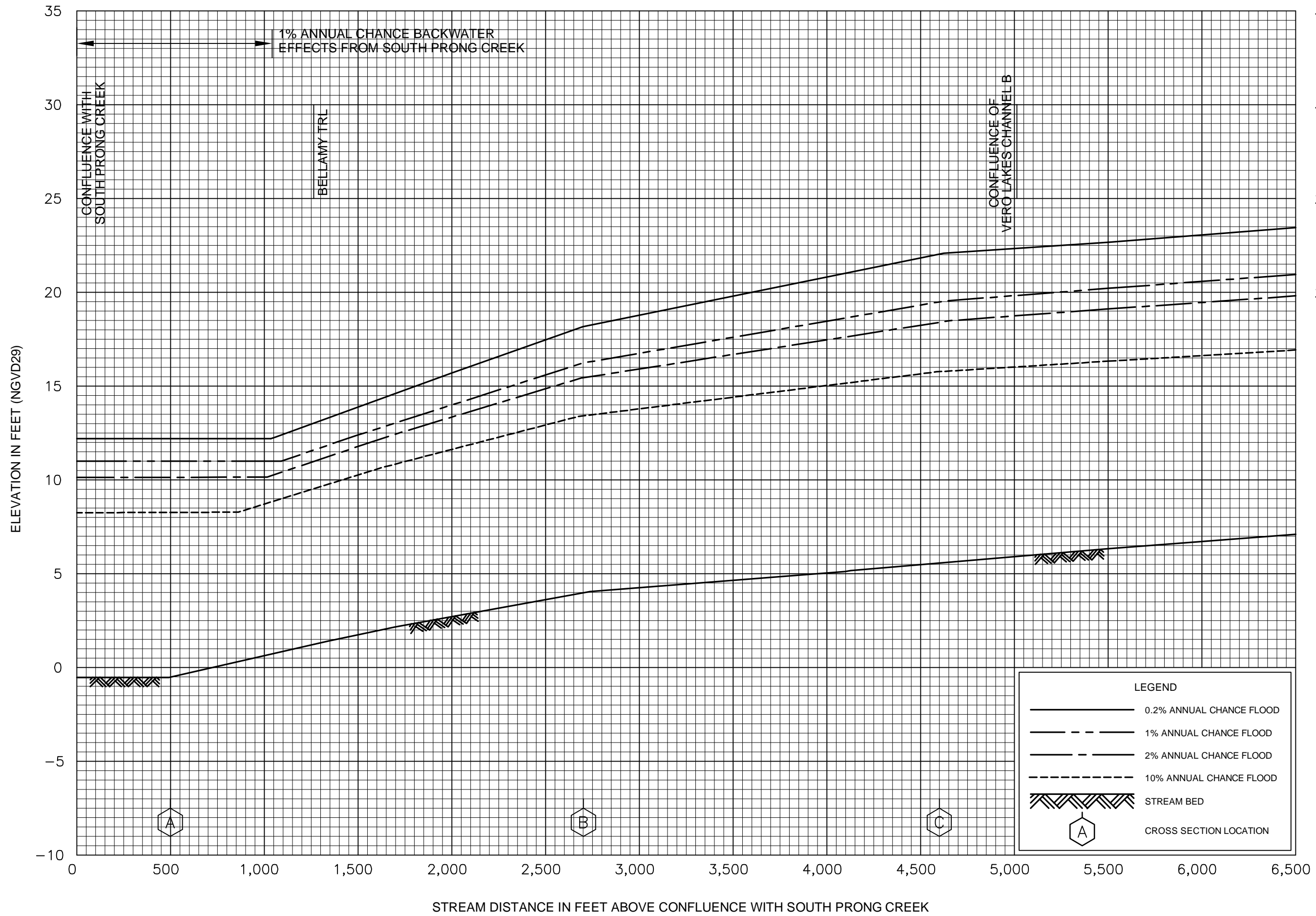
LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES
ST. JOHN'S MARSH

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS

26P

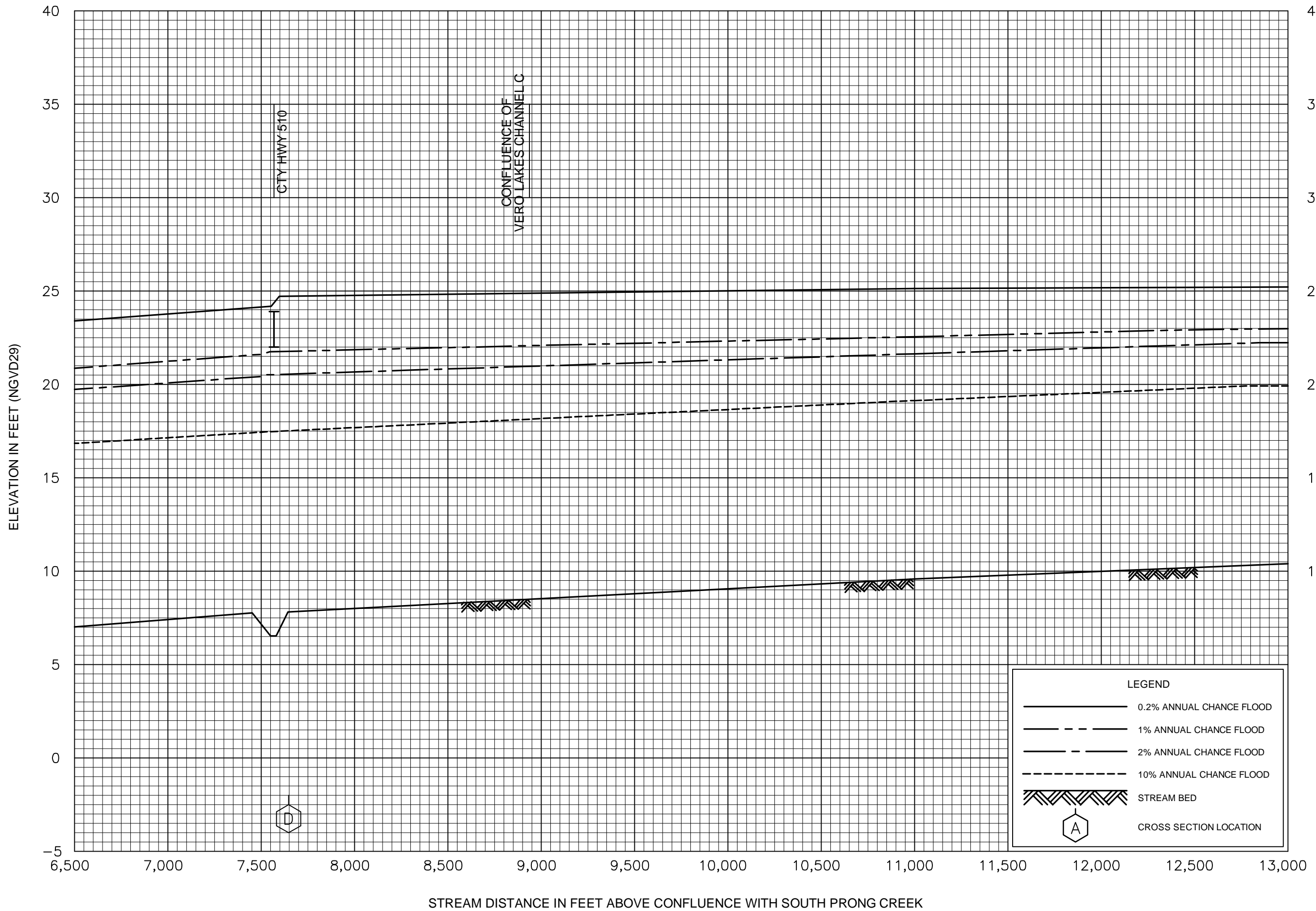


FLOOD PROFILES

VERO LAKES CHANNEL A

FEDERAL EMERGENCY MANAGEMENT AGENCY

INDIAN RIVER COUNTY, FL
AND INCORPORATED AREAS

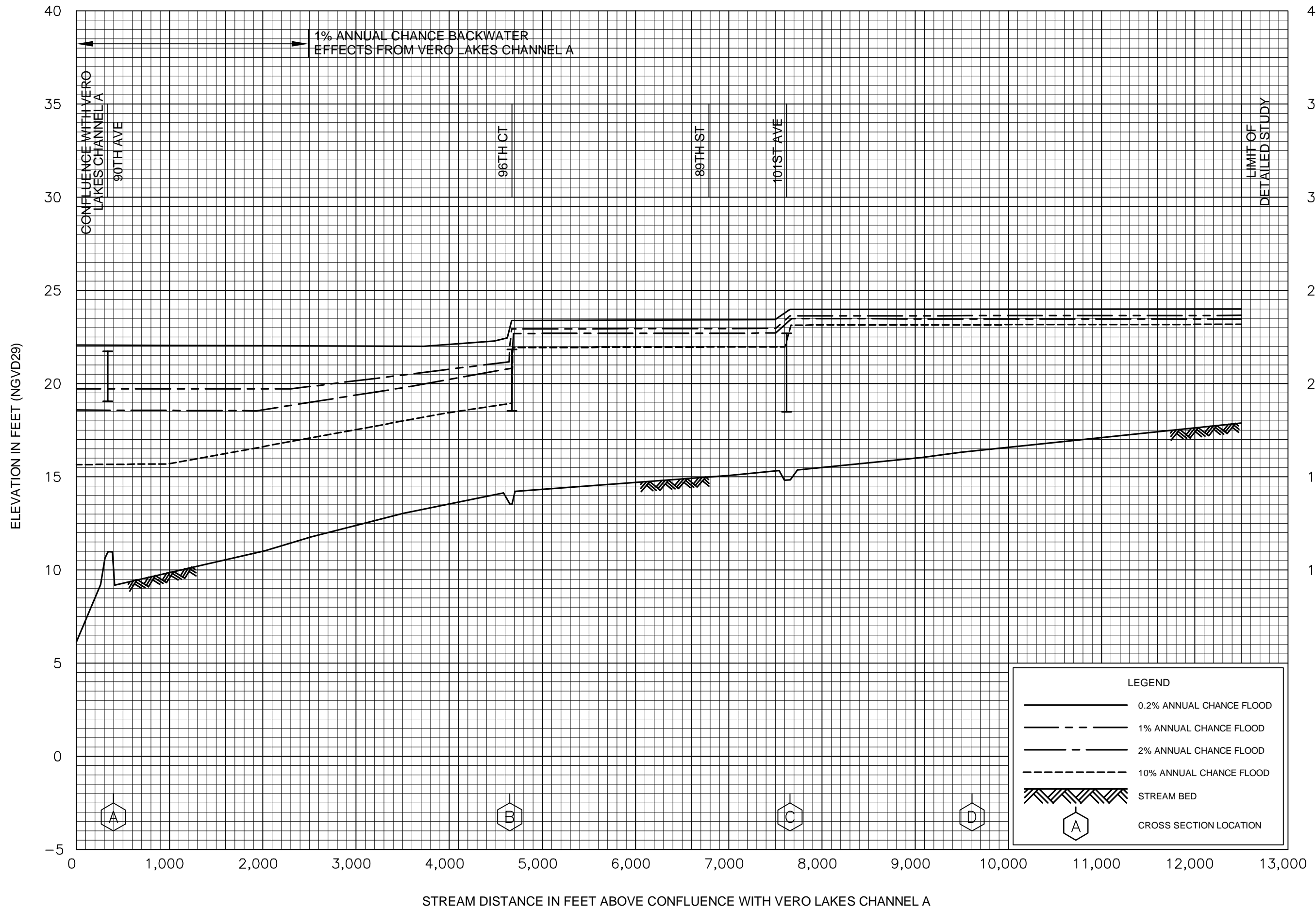


FLOOD PROFILES

VERO LAKES CHANNEL A

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

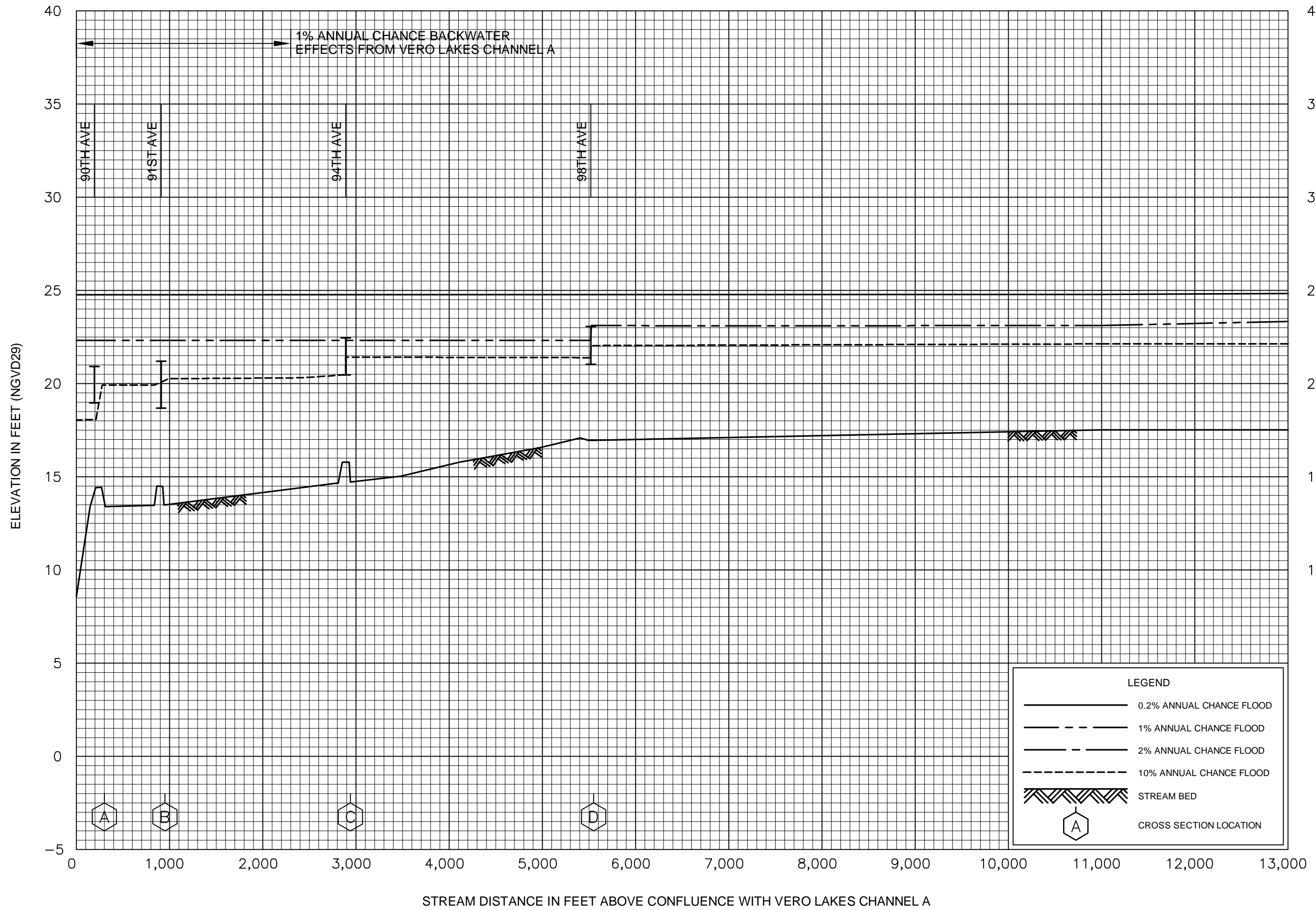
28P



FLOOD PROFILES

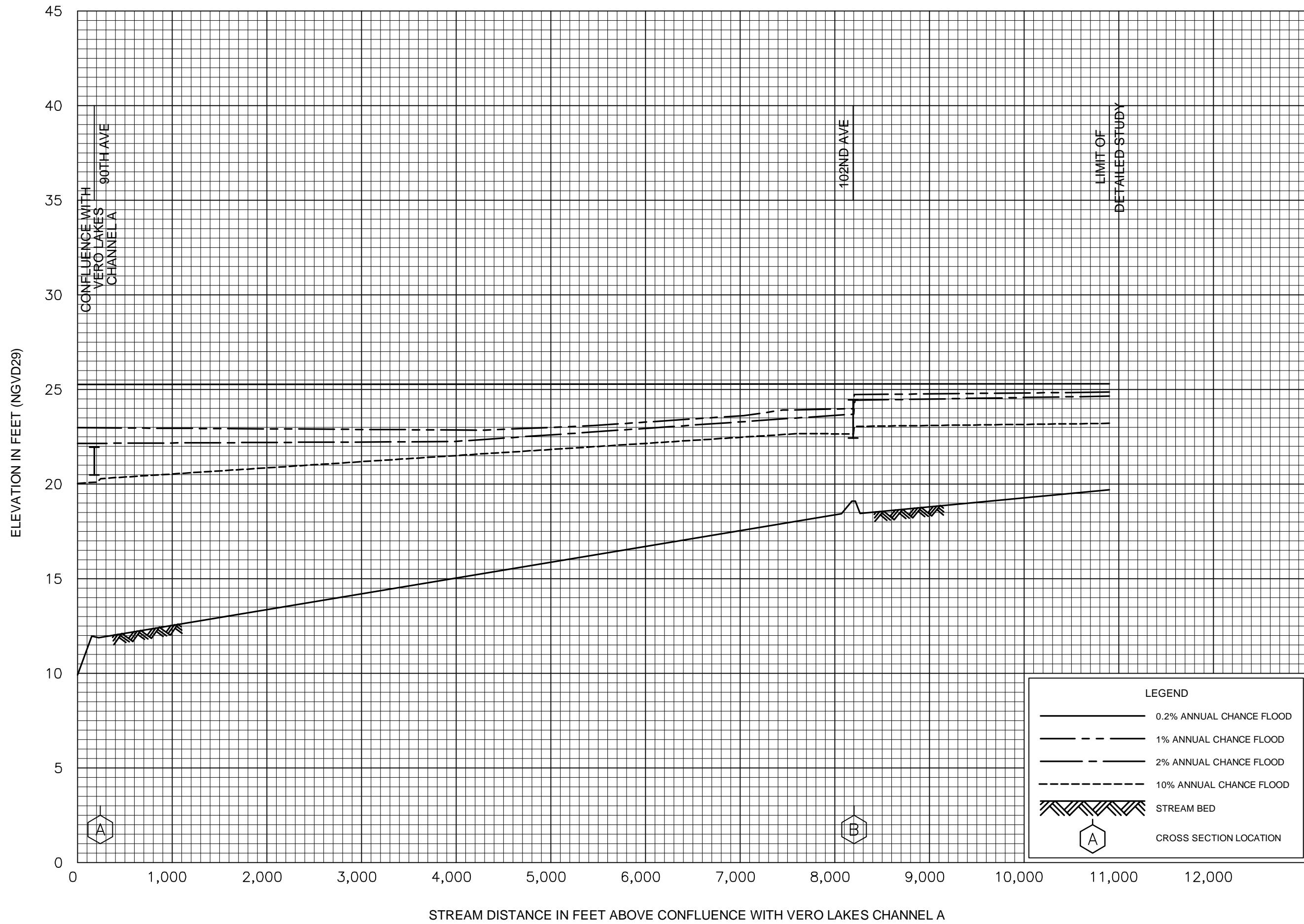
VERO LAKES CHANNEL B

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS



FLOOD PROFILES
 VERO LAKES CHANNEL C

FEDERAL EMERGENCY MANAGEMENT AGENCY
 INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS



FLOOD PROFILES

VERO LAKES CHANNEL D

FEDERAL EMERGENCY MANAGEMENT AGENCY
INDIAN RIVER COUNTY, FL
 AND INCORPORATED AREAS

33P